WITH THE TERRORISTS OF THE HIGH SEAS By Martin Sheridan

OCTOBER 1942 • 35 CENTS

Travel

Coming EVENTS

Connecticut
Open year 'round Art Exhibit—Benjamin Collection of Mediterranean Antiquities; Miner Collection of Americana; Lyman Allyn Museum, New London
To October 1—Work of students in departments of architecture, drama, painting and sculpture; Americana; early Italian paintings; Greek pottery, antiquities from Dura Europos; textiles—Yale University Art Gallery, New Haven
Sept. 30—Guilford Fair, Guilford
Oct. 1 to 3—Stafford Fair, Stafford Springs, Conn.
Oct. 3—Harwinton Fair, Harwinton
Oct. 11—Skeet and Trap Shoots, Fairfield Gun Club, Fairfield
Oct. 18—Skeet and Trap Shoots, Norwalk Gun Club, Norwalk
Nov. 10 to 13—Antique Show, Hotel Bond, Hartford

Delaware
To October 25—Exhibitions: Chinese Painting of the XVIII, XIX and XX Centuries—Delaware Art Center Bldg., Wilmington
Dec. 7—Delaware Day (anniversary of Delaware's signing of U. S. Constitution), State-wide

Illinois
Oct. 18—Football—New York Football Giants against Chicago Bears, Chicago

Maine
Oct. 1—Leeds Agricultural Association Fair, Leeds Center
Oct. 6 to 7—Litchfield Farmers' Club Fair, Litchfield
Oct. 6 to 8—West Oxford Agricultural Ass'n Fair, Fryeburg
Oct. 13 to 15—Sagadahoc Agricultural & Horticultural Soc. Fair, Topsham
Oct. 19 to 24—Maine Blue Ribbon Fair, Lewiston, Maine
Nov. 3 to 5—Androscoggin Poultry and Pet Stock Ass'n Fair, Lewiston
Dec. 9 to 11—Maine Poultry Association Fair, Portland

Maryland
To Oct. 18—"Paintings of Ethel Vincent Van Gogh," an exhibition at the Baltimore Museum of Art
To Oct. 27—Racing at Laurel
Oct. 17—Navy vs. Yale, football, at the Baltimore Stadium
Oct. 28 to Nov. 11—Racing at Pimlico
Nov. 12 to 28—Racing at Bowie
Nov. 14—Navy vs. Columbia, football, at the Baltimore Stadium

Massachusetts
Oct. 2 to 3—Littleville Community Fair, Huntington
Oct. 12—Plymouth County Agricultural Society Fair, Bridgewater
Nov. 6 to 8—Bristol County Agricultural Society Fair, Segreganset
Oct. 7 to 9—Harvest Show, Massachusetts Horticultural Society, Horticultural Hall, Boston
Nov. 5 to 8—Autumn Exhibition, Mass. Hort. Society, Horticultural Hall, Boston
Oct. 4—Competition for Creedmoor Cup, free rifle, Walnut Hill Range, Woburn
Oct. 18—Dr. C. C. Foster Match, any rifle, Walnut Hill Range, Woburn
Dec. 26 to 28—National Girls' Indoor Championships (Tennis Tournaments Junior), Longwood Covered Courts, Chestnut Hill

New Hampshire
To Oct. 18—Art Exhibit, Regional Building, Carpenter Galleries, Dartmouth College, Hanover
To Oct. 31—Second Annual Art Show, State Library, Concord
To Oct. 1—Hopkinton Fair, Hopkinton
Oct. 2 to 3—Deerfield Fair, Deerfield
Oct. 12—Fair, Sandwich, N. H.
To Oct. 12—Operation of Mt. Washington Cog Railway, Mt. Washington

New Jersey
To Oct. 3—The New Jersey State Fair, Trenton
Will close on Nov. 30—The Governor's New Jersey Fishing Tournament, entries for which are being received by the New Jersey Council, Trenton

New York
To Oct. 3—Union Agrl. & Hort. Society of Ulysses, Covert and Hector (Tompkins Co.) Fair, Trumansburg
To Oct. 10—Racing at Belmont Park
Oct. 12 to 21—Racing at Jamaica
Oct. 2—Boxing—Stolz vs. Angott—Madison Square Garden, New York
Oct. 7 to Oct. 20—Rodeo—Madison Square Garden, N. Y.
Oct. 30—Boxing—Madison Square Garden, N. Y.
Oct. 11 — Football — Brooklyn Dodgers against Pittsburgh, Ebbetts Field, Brooklyn
Oct. 18 — Football — Brooklyn Dodgers against Washington, Ebbetts Field
Oct. 25 — Football — Brooklyn Dodgers against New York Football Giants, Ebbetts Field
Nov. 1 — Football — Brooklyn Dodgers against Cleveland, Ebbetts Field
Nov. 8 — Football — Brooklyn Dodgers against Chicago Bears, Ebbetts Field
Nov. 15 — Football — Brooklyn Dodgers against Philadelphia, Ebbetts Field
Oct. 11—Football—New York Football Giants against Philadelphia, Polo Grounds, New York
Nov. 1—Football—New York Football Giants against Pittsburgh, Polo Grounds, New York
Nov. 15—Football—New York Football Giants against Washington, Polo Grounds
Nov. 22—Football—New York Football Giants against Green Bay, Polo Grounds
Nov. 29—Football—New York Football Giants against Cardinals, Polo Grounds
Dec. 6—Football—New York Football Giants against Brooklyn, Polo Grounds

Pennsylvania
To Oct. 3—87th Annual Columbia County Fair, Bloomsburg
Oct. 4—Football—New York Football Giants against Pittsburgh, Pittsburgh
Oct. 8 to 17—Food Show and Exhibit of Home Appliances, Philadelphia
Oct. 13—Opening of Harrisburg Symphony Orchestra Season, Harrisburg
Oct. 31—University of Pennsylvania and Army Football Game, Philadelphia
Nov. 8—Football—New York Football Giants against Philadelphia, Philadelphia

Rhode Island
To Nov. 11—Pascoag Track, Burrillville—Racing

Tennessee
Oct. 26 to Nov. 14—Wild Boar and Bear Hunt, Tellico Plains

Vermont
(Due to war-time conditions, the usual fairs have all been canceled)

Virginia
Week of Oct. 4—Annual Fall Golf Championships, The Homestead, Hot Springs
Oct. 10 to 11—Pro-Amateur Golf Tournament, The Homestead, Hot Springs
Oct. 12—Anniversary exercises on the death of Robert E. Lee and opening of the annual Fall Council of the Robert E. Lee Memorial Foundation, Stratford Hall, Westmoreland County
Week of Oct. 12—Annual Fall Golf Tournament, The Homestead, Hot Springs
Oct. 16 to 17—Bath County Field Trials, The Homestead, Hot Springs
Oct. 19—Yorktown Day Celebration in memory of the surrender at Yorktown of Lord Cornwallis to George Washington and his Allies, by Comte de Grasse Chapter, Daughters of the American Revolution, Yorktown
Oct. 24 (tentative)—Alumni Homecoming Day. Football game with George Washington University. College of William and Mary, Williamsburg
Oct. 25—Thirteenth Annual Field Mass in honor of the First Catholic Settlers in Virginia, on the Feast of Christ the King. Aquia
Oct. to March—Fox hunting by more than a dozen nationally recognized hunts chiefly in Northern Virginia and Albemarle County. Introduction to the Master of the Hunt essential to invitation to ride. Hunts are generally held four days a week
Nov. 11—Founders' Day Celebration. Virginia Military Institute, Lexington
Dec. 5—Annual Celebration of the founding of Phi Beta Kappa by William and Mary students, Dec. 5, 1775. Private dinner in Raleigh Tavern. Public exercises with address and poem in auditorium of the Phi Beta Kappa Building, College of William and Mary, Williamsburg

West Virginia
Oct. 31 to Nov. 1—Mountain State Forest Festival, Elkins
Oct. 31 to Nov. 1—Buckwheat Festival, Kingwood
Oct. 12—Community Music Concert—opera "La Boheme," Charleston
Oct. 27—Charleston Symphony Orchestra Concert, Charleston

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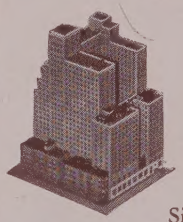

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Travel

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Willard Fairchild, *Art Director*

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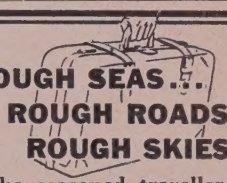

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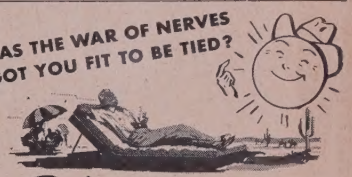

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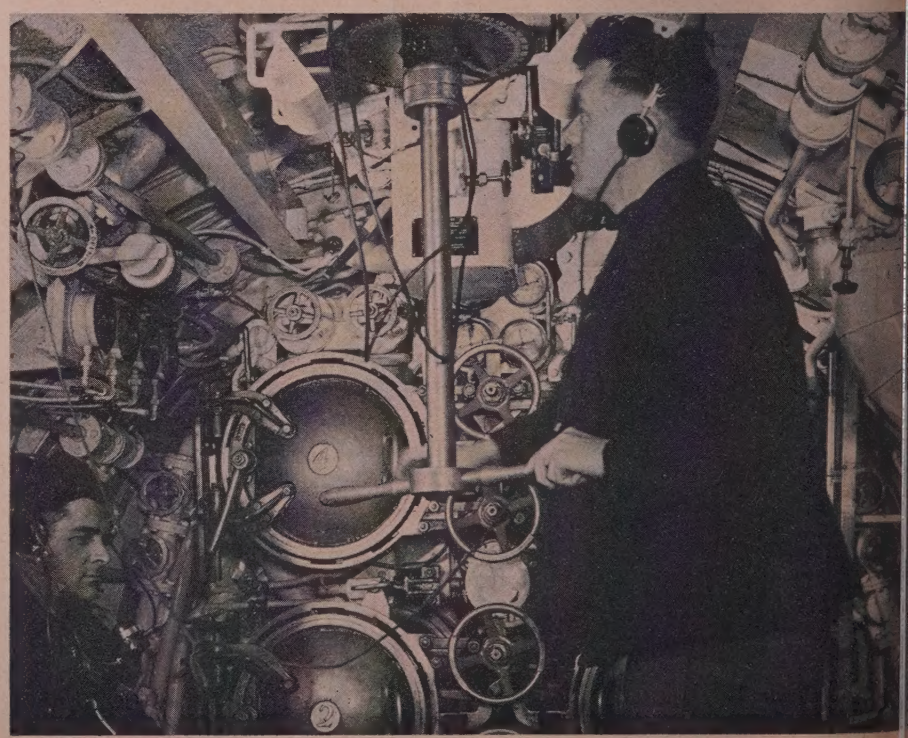
P.P.C.

A SEA PROWLER RETURNS

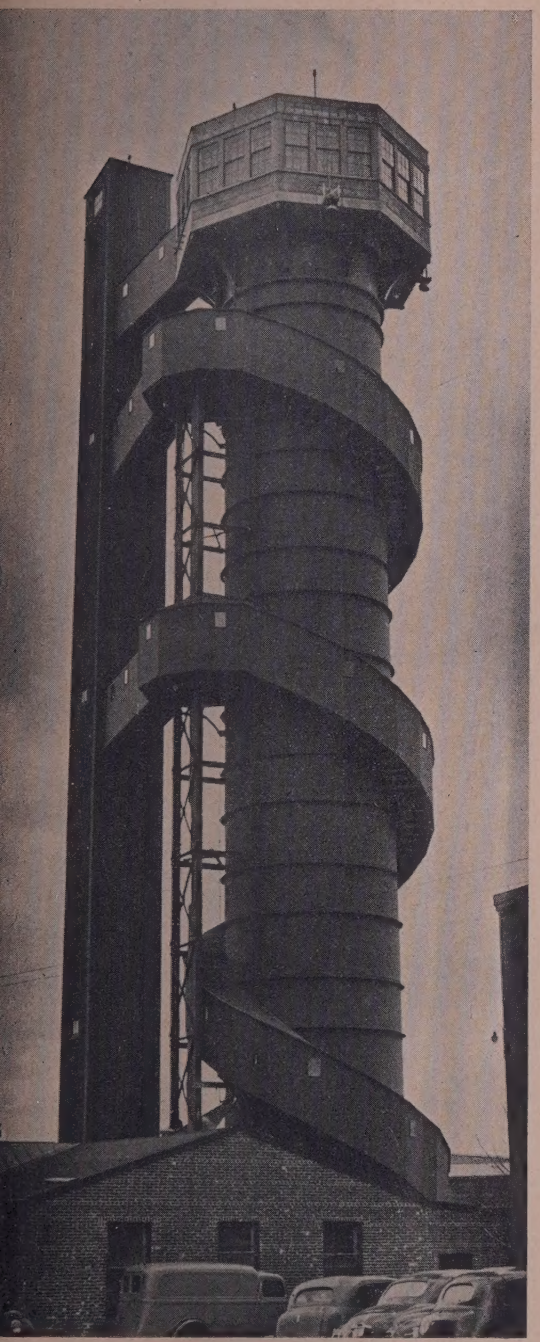
It has been an active day for Uncle Sam's "87" which has just returned from a long day's cruise over and under the water. When it submerged the submarine's ballast tanks were filled with water. To reach the surface again, the water was forced out of the ballast tanks by compressed air which gives the boat sufficient buoyancy to float at sea-level. At the right is the forward torpedo compartment where the tubes are always loaded with "tin fish" and ready for action.



Travel

VOL. LXXIX, NO. 6 OCTOBER, 1942

t New London a 135-foot water tower has been built
train men in the use of the underwater escape lung.



THE shore siren had just screamed the signal for colors as I boarded a grim, black submarine at an Eastern naval base. Men snapped to attention, holding their salutes until the flags fluttered into position against the pale blue sky.

It was eight o'clock and the start of a new day and a new patrol for the submersible. The few steps from the dock to the deck were an introduction to a whole new world. An amazing world of steel and machinery and venturous men who must operate just as efficiently as that machinery. A world that the war suddenly made more important.

Fog-like above the water rolled the exhaust of the warming Diesel engines. Thirty crew members had come aboard and signed on. Some went below to take their stations, others remained on deck to haul in the gangplank and fasten it to the deckwork. I was the only passenger.

The most striking thing to me is the way submariners seem to become a part of the craft as soon as they step aboard. Each man has a special station, a special valve to turn, a lever to shift, a signal light or a gauge to watch. It's like a giant jigsaw puzzle where every piece has its place and one missing piece can disorganize all the rest.

The quartermaster, for example, climbed to the bridge and clamped a set of earphones over his head. He didn't pause to wonder if the man in the main operating compartment would be ready. He knew he'd be waiting for the first order.

When the youthful looking master of the sub stepped briskly aboard with orders from the operations officer, the second officer said simply, "Ready for getting under way, sir."

"Very well," acknowledged the skipper, glancing over his ship from stem to stern. He signaled to the bridge.

"Answer all bells," the quartermaster spoke into his phone. "Take in all lines. All back full. Left full rudder."

It was as smooth as that. The Diesel engines throbbed more noticeably. We cleared the dock, swung around with the current and nosed out to the open sea at eleven knots. Out of nowhere a Negro mess boy appeared with two huge mugs of steaming coffee for the skipper and me. How he managed to climb up the after hatch without spilling the welcome refreshment is still a mystery to me.

A few minutes later a seaman removed the colors and sent the flag below. Overhead a Navy patrol plane circled inquisitively then wobbled its wings in greeting.

"Rig out the bow planes," called the skipper. Immediately a pair of black wings opened at the bow of the sub. Extending from the nose somewhat like the flippers of a fish, these planes when submerged guide the vessel upward or downward. The stern planes, which are nonretractible, keep the ship on an even keel.

As soon as the sub cleared the protective steel nets at the mouth of the harbor the forward and after hatches were slammed shut and locked for diving. The net tender tooted a last shrill farewell. "Let's go below," said the skipper, and I followed him down the conning tower ladder, leaving only a lookout and the operating officer on the bridge.

The activity below at that moment resembled a mass strip tease in a burlesque

ITH THE *Terrorists* OF THE HIGH SEAS

By MARTIN SHERIDAN

With photographs by the author

house. Every man, including the skipper, was peeling off clothing—overshoes, trousers, shirts. When they came to their undershirts and shorts they stopped.

"You might as well join us," chuckled one of the officers. "We like our subs warm."

American submariners dress for comfort and quick action on war patrol, in great contrast to British and Nazi crews who prefer scarfs and turtle neck sweaters and a cool operating compartment.

The modern American sub is a surprisingly bright and comfortable place. Its interior shines with white paintwork and brightwork. If you look closely you'll find pieces of cork mixed with the paint to absorb the moisture that forms when operating submerged. The ship has showers and washrooms, two-bunk staterooms for officers, refrigerating machinery and an evaporating plant to produce fresh drinking water from the sea water.

Life aboard a sub today is more pleasant than during the first world war when air conditioning was unknown. The early ships were called "sea pigs", or "pigboats", probably because they resembled pigs—they were shiny and black, sometimes stuck their noses into the mud, and snorted loudly as their engines were revved up.

The older, smaller subs became almost unlivable after three or four weeks at sea. Confine a group of healthy, perspiring men below decks for a long period with no ventilation, and you'll understand why some sailors longed to be in Davey Jones' locker. The stench was not unlike the interior of a fifty-year-old high school athletic locker room. Water poured from the men's pores as soon as they gulped it down.

Standing orders direct the skipper to seek out and destroy the enemy. And it's a fallacy that a submarine cannot fight another submarine because several cases of a pigboat sinking another pigboat already have been recorded.

"We shoot first and ask questions afterward—if there is anyone left to question," the submarine skipper reveals laconically. "The Nazis and the Japs don't fight according to the rules of international law. To win this scrap we are giving them a double dose of their own medicine."

According to international law—almost as extinct as the dodo—a submarine must warn an unescorted and unarmed merchantman before loosing torpedoes at her. Compliance with this rule, however, would be equivalent to asking for a lethal punch in the jaw since deck guns might be camouflaged or hidden and a single shell would pierce the sub's thin outer skin.

War patrols by submarines are extended, nerve wracking operations continuing from forty-five to ninety days at sea. Nearsighted and almost blind, the subs operate submerged most of the time, navigating with the aid of delicate instruments and an occasional peek through the periscopes if the surface is clear.

As soon as we reached deep water—about five miles offshore—the sub was rigged for diving. Air vents were closed. The crew stood ready at diving stations.

There is no such command as "crash dive" on a sub. Every dive is made as quickly as possible. The rapidity and smoothness of operation depend on the training and ability of the personnel. While it's a military secret to disclose the exact length of time required to duck from the surface, we can safely reveal that a sub can submerge quicker than you can pronounce Llanfairpwllgwyngyllgogerychwyrndrobwllllandysiliogogogoch, a Welsh town.

I watched the first dive through a port in the conning tower. As we started to submerge, the Diesel engines ceased to throb and powerful electric motors, fed from 120 great 1600-pound cells, took up their job.

At first the craft settled slowly, then it moved ahead, downward. Water covered the deckwork, lapped gray-green at the ports a moment later. We passed the thirty foot mark. The electric motors were quiet. Voices were low. Movements were unhurried. And, what surprised me most, there was almost no sensation to the operation. Only occasionally will a man make an incorrect trim so that the angle of diving exceeds four or five degrees, and this is quickly corrected. Once I felt some pressure in my ears, but a swallow cleared it.

The nerve center of the ship is the control room where every movement is registered on dials: its depth, its speed, its water pressure, the position of its important valves. And aboard a submarine every valve is important.

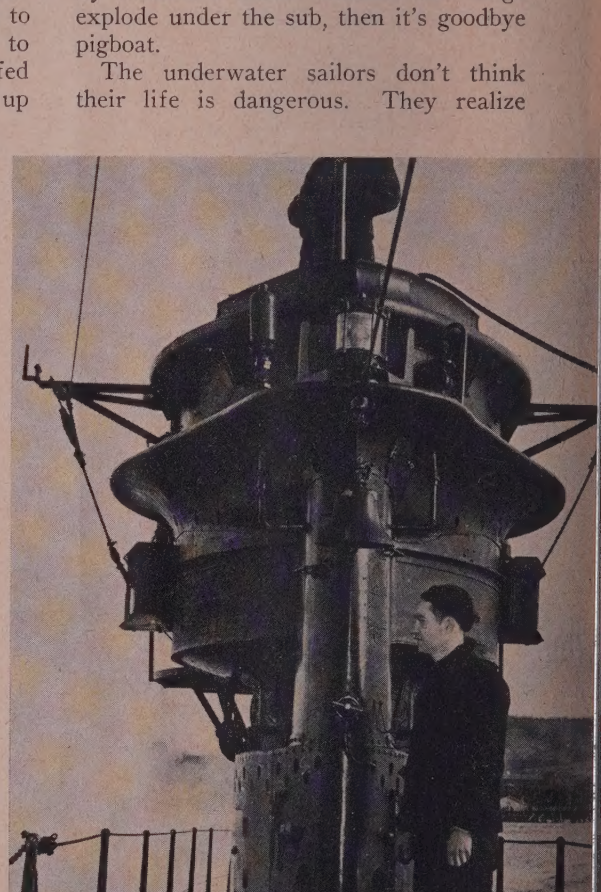
Open up a hole in the hull of any surface vessel below the water line and she will settle down and sink, due to the weight of water taken on board. That is precisely what is done to a submarine to get it below the surface—only the water flows through huge valves into tanks along the sides and underneath.

A submarine sinks because its ballast tanks are filled with water. It surfaces when this water is forced out with compressed air. And it remains on an even, or almost even, keel because water is let into or forced out of its trimming tanks. Large fast-acting valves, called Kingstons after their inventor, admit the water swiftly, although to reduce strain the ship is levelled off every fifteen feet or so.

"If an enemy warship appears," the skipper points out, "all we have to do is submerge to a safe depth. Through careful handling we can keep the ship suspended on an even keel with her motors turned off. And no listening device in the world can locate a static submarine. Under such circumstances the sub is in such perfect balance that a single 150 pound man walking from the bow to the stern will upset the delicate equilibrium."

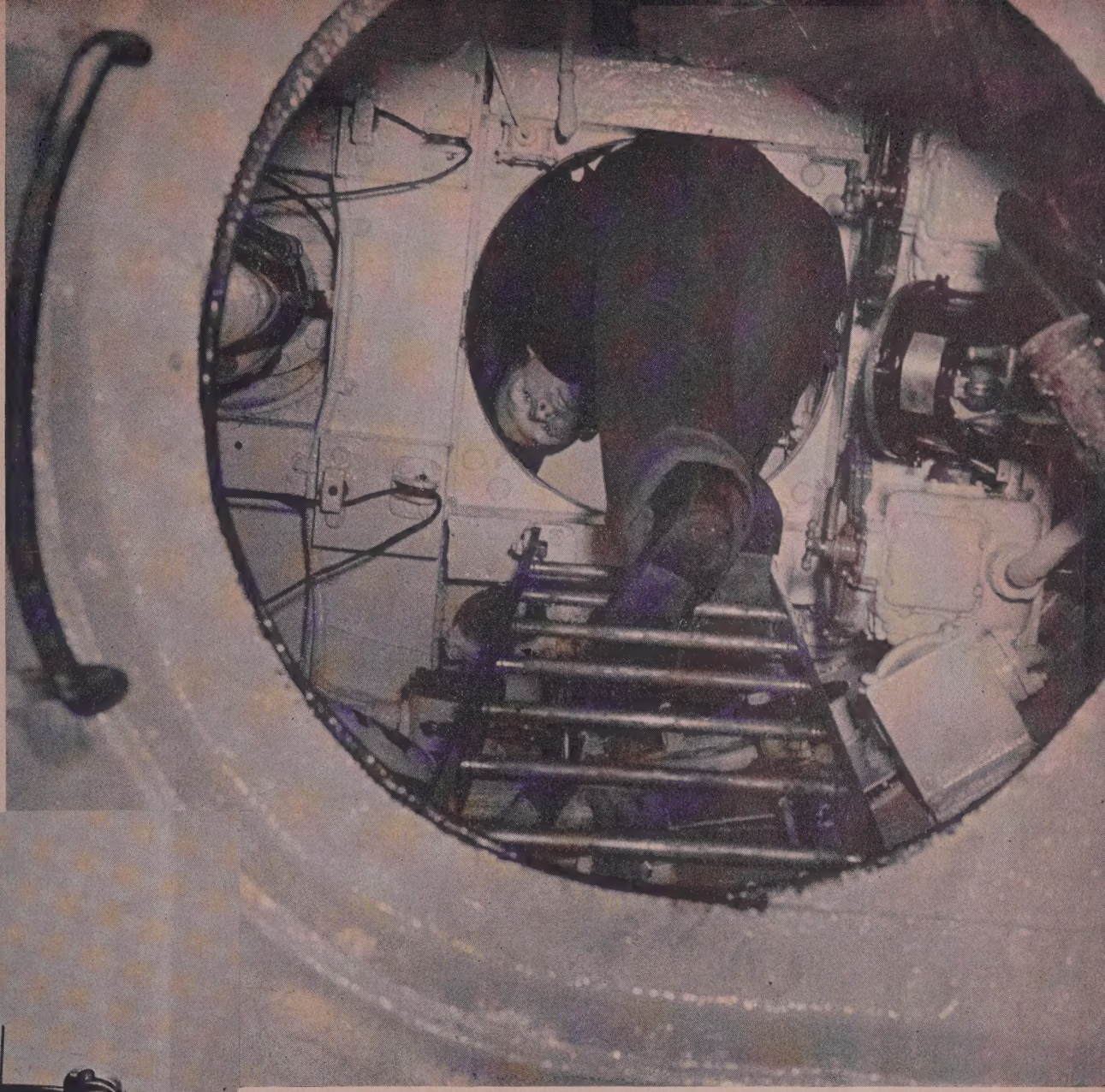
Submariners do not greatly fear depth bombs for only a direct hit or a close explosion can knock out their pigboat. Since the water pressure increases with the depth of the water, the depth charges explode upward. The underwater concussion is frightful, increasing in intensity in shallow water. Should the charge explode under the sub, then it's goodbye pigboat.

The underwater sailors don't think their life is dangerous. They realize



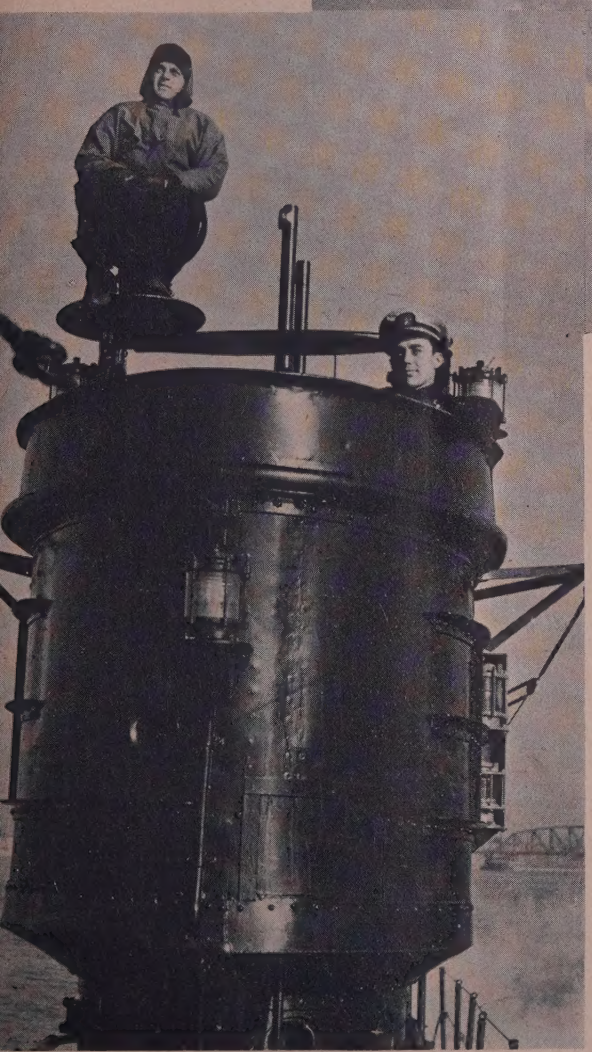
THE EYES OF THE SUB

The older submarines have narrow, uncomfortable c ning towers. Our Navy ordered its first submarine in 19 and the first periscope was introduced in 1902. Nowad ordinary submarines have two periscopes and the larg have three.



TO YOUR POSTS

The submarine is preparing to dive and the last sailor is coming down the conning tower hatch. The air vents are being closed; the crew stands ready at diving stations and soon the Diesel engines will cease to throb and the boat will depend upon its electric motors for underwater power.

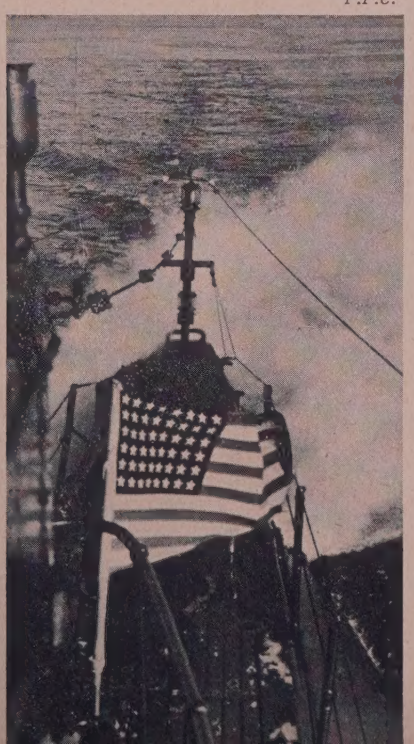


HEADING OUT TO SEA

r submarines perform the most hazardous of all deep operations and they are now operating in all the oceans the world. Their work in Japanese waters has been specially effective.

This is a view of the deck of a submarine when it is skimming along the surface of the sea.

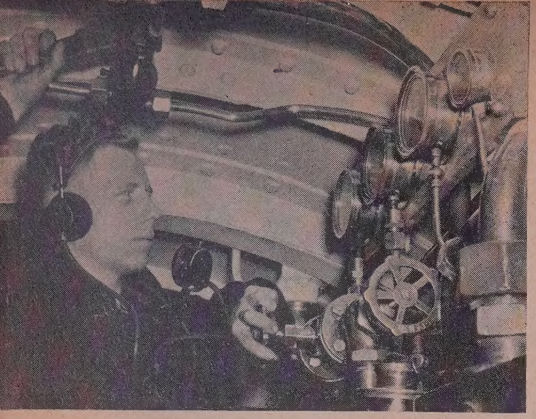
P.P.C.



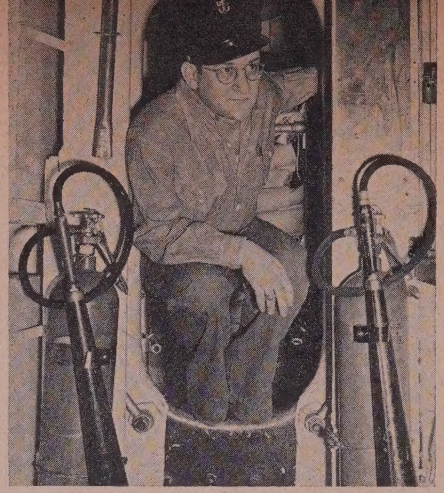
their ship is a piece of intricate machinery, perfectly safe as long as the crew is efficient and on its toes. Furthermore, they tell you proudly that most insurance companies have crossed the crews of submarines from the "bad risk" list. The only thing the men fear is underwater collision. As a safety measure all compartment doors are sealed during wartime underwater operations.

It is practically impossible for anyone to differentiate between enemy or friendly submarines when they are submerged. Sound devices cannot identify nationalities at this writing. And only an experienced man can determine the origin of a surfaced sub by its silhouette.

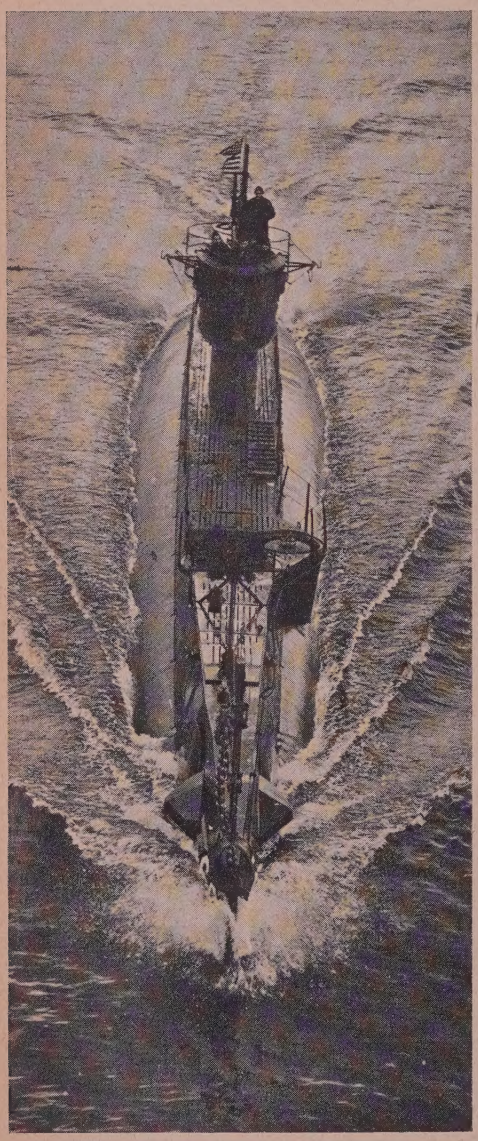
All subs look pretty much alike when spotted submerged from a patrol plane. And our own underseas craft might easily be mistaken for an enemy sub with results that would easily be disastrous. While our ship was crawling through the water at one hundred and ten feet I be-



Watching the gauges sharply this sailor listens for the order to cut in the compressed air. This will drive the water out of the ballast tanks and bring the ship to the surface.



Small men get along best in submarines. This picture shows the size of a sub's compartmentway.



HOME FROM THE HIGH SEAS

Her colors flying this submarine steams swiftly up a naval harbor after a cruise in North Atlantic waters. Cruises are long, arduous and hazardous and last from forty to ninety days.

came aware of a crescendoing overhead roar similar to a subway train pulling into and out of a station.

"Only a destroyer," the skipper smiled at my concern. "No doubt one of ours, but I'll take a peek through old Cyclops and check."

We rose almost to the surface. The master pressed a button which extended the periscope a foot above the water. He unfolded the arms, focussed and scanned the surface.

"Dive to one hundred and fifty feet," the young sea dog commanded as he telescoped the periscope back into the sub.

Water began to trickle in through the hatches when we passed the one hundred foot level. I was downing a mug of coffee when the collision alarm siren howled its warning over and over again, raising goose pimples on my teeth.

"Collision forward torpedo room," someone yelled. The motors were shut down; the main lights went out and emergency lanterns on. Half a dozen men from the torpedo compartment scurried out, shutting the heavy safety door behind them. It was silent except for the gurgling sounds of water running through the Kingstons as the sub was leveled off.

I thought of my camera equipment. Perspiration poured from my forehead; my heart pounded excitedly. Nobody moved or said anything. After five minutes of mental torture, the skipper yelled "Secure from collision drill!" The men hurried back into the forward compartment. Lights were snapped on. I clung to a stanchion.

Someone ordered the smoking lamp lighted and most of the crew lighted cigarettes in the control room and after battery room. Actually, no lamp is lighted. The command is a holdover from the old days when an oil lamp really was the signal that smoking was in order.

In case of any emergency—real or simulated—the men closest to the safety doors or valves or switches go into action. Speed is the keynote aboard a sub for the safety of every man depends upon the clear-thinking and efficiency of each.

Submariners have only one meal a day but that lasts from early morning until late at night. Electric percolators brew coffee twenty-four hours a day as a morale builder. And food lockers are kept open for foraging to uphold the good humor of the crew.

Except for a game of cards, checkers, cribbage or that old favorite of World War number one—acey ducey, there was little opportunity for recreation. Despite the fact that the crew cannot exercise, no one becomes fat. To counteract the effects of this inactivity, nervous tension, lack of sunlight and fresh food, Navy dieticians augment the sub crew's diet with special multi-vitamins.

"Cookie" is the most pampered man on board. His requests for help will immediately bring forth a dozen volunteers. But I can't quite forgive him for slicing onions during every long dive and converting strong men into weepers.

If it weren't for the fact that the commanding officer occasionally wears a cap through force of habit, it would be impossible to single out a lowly seaman from the skipper, garbed as they are in their unmentionables. But the informality makes for greater co-operation. The skipper has implicit confidence in the ability of his men to carry out orders; the crew have complete faith in their master. They never forget that he is their boss.

The submarine master has more power than any other commanding officer of a Navy vessel. He can remove any officer or man from the crew by merely scribbling on his papers, "temperamentally unsuited for submarining." His decision is iron-clad and there can be no appeal.

With the third year of total war on the four fronts—land, sea, air and airwaves—at an end, the influence of sea power on the final decision remains the paramount factor. And the most important unit of all in modern navies is the submarine, long, cigar-shaped, almost invisible on the surface and ever ready to spout death and destruction. Unlike the rattlesnake which hides in the tall grass and warns its enemies by a dry, tubercular rattle, the submarine strikes swiftly and silently, then disappears.

(Continued on page 31)

SHORE LEAVE

One of the boats that ply the inland waters of Bermuda unloads a group of sailors eager to cram excitement into every minute of their leave. They will be well received with numerous entertainments by the hospitable Bermudians.

HOW AMERICA INVADED BERMUDA

By MARY M. STRUVE

Bermudians are hugely amused by the inability of many Americans to cope with the bicycle. They remember that it was the Americans who first brought the bicycle to Bermuda in 1890.

BERMUDA lies beyond the Gulf Stream, a cluster of coral encrusted pinnacles of great mountains drowned in 2500 fathoms of sea. It is an archipelago of islands, keys and rocks, "one for every day in the year." Nineteen and a half square miles (Manhattan Island has twenty-two) is the area of this British Crown Colony established in 1612. In late 1940 one twenty-fourth of the area was leased to the United States Government for conversion into a vital fortress with all the adjuncts of a modern military garrison.

Thus commenced the "American Invasion." Barracks had to be erected on St. David's Island for a young army. The advance guard of construction workers which was transported in all available ships, jammed every hotel, guest house and spare room in the ancient capital of St. George in Bermuda's historic east end.

To remedy the housing shortage the *Berkshire,* a vast pyramid of fragile gingerbread built for the calm Hudson, was towed through the Gulf Stream to serve as a floating hotel. "The Old Man's Home" they call this barge, overloaded with brawn and beer, and chained to the shore of St. David's

Of the five hundred acres of St. David's Islands, which is fifty-eight less than the area of La Guardia Airport, three hundred acres were immediately placed under the American bulldozer. The wind-break cedars were yanked off, hills leveled, onion and lily fields scraped and the remains of an ancient burial grounds disinterred.

St. David's had been a little world unto itself, inhabited by a gentle race of recluses, farmers and fishermen, some of whom have never left

ALLIES IN BERMUDA

American gobs, British sailors and Cameron Highlanders strike up friendships on Bermuda's crowded streets and in its restaurants and bars.

HAMILTON HARBOR

Not long ago Hamilton's deep harbor was filled with gay white liners crowded with tourists and with numerous smart yachts and sail boats. Today it is a haven for the grim transports and cargo ships of the Allied Nations.

their island. This group has been uprooted by the Yank's invasion of their island home. I tramped over what had been banana groves and lily fields on Tommy Fox's twenty-seven acres—rich soil, for which the Bermuda Government is paying this eighty-year-old local whaling authority $2,000 an acre. It was disheartening to watch one of the thick coral-walled houses being pushed over by a caterpillar tractor as easily as an elephant dislodges a tree. No hurricane has ever blown down a Bermuda house.

As we sat in his herb garden, Benny Lamb saddened when he spoke of his family's rehabilitation. "The peace has gone out of Bermuda, but it will come back . . . we are grateful to the Americans for their protection."

"I am prepared to forego something but I want at least a view," was Heber Pitcher's reaction to his impending evacuation. A descendant of pilots, Heber serves his king by skilfully navigating the hazardous reefs which encompass these mid-ocean dots for ten miles to sea.

The beacon in St. David's Light has been snuffed out since December 7. The blackout is complete. "Easter lilies don't grow any more on St. David's," said one of the lighthouse keepers as we sat shaded by the flame-tipped royal poinciana tree. "There's going to be a town down here. Houses are sprouting on the slope and over the old lily beds too."

On leased Long Bird Island, less than five thousand square feet, the army land plane base was completed in a furious hurry by two thousand skilled American workmen who with dynamite, dredges and screaming jackhammers blasted the coral hills to a uniform level and filled in the surrounding shoal waters. Yesterday there were dainty coral roads for the horse-drawn carriage, a lingering symbol of the tempo of life in the Bermudas; today there are wide modern runways for the latest type of bomber. Such contrasts are typical of the jolts given peaceful Bermuda in her temporary nightmare due to the fervent activities of her new patron, Uncle Sam.

A Fleet Operating Base and model Naval Air Station have emerged from the devastating work on Tucker's and Morgan's Islands, two tiny cedar-covered coral mounds in Great Sound which have been joined together and to the mainland. Here the Marines live in grey corrugated barracks, an ugly note in Bermuda's color scheme of pastel pink, blue, green and white.

During the last phase of the leveling operations, a Marine Officer invited my inspection of the "mess" they had made of old Captain Tucker's island, rich in cedars, red marl soil and stalagmite caves. He apologized for the dust dried by drought and churned up by trucks. Then we plunged into the desert of red powder up to our sock tops and waded a mile across country past piles of burning cedar roots and past blasting charges. We choked and sneezed behind giant jostling trucks, and shuddered at the din from bulldozers and jackhammers.

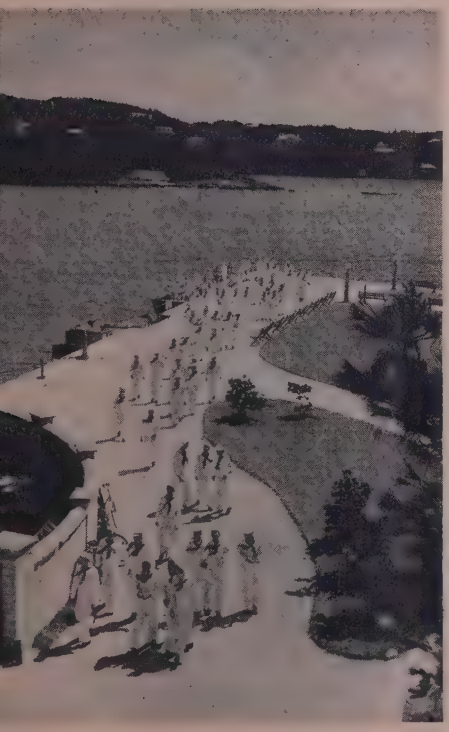
"A few days ago," said my guide, "they ignited dynamite to blast off a hill but instead the rock collapsed into a beautiful stalactite cave." Like a sponge, these islands! Perhaps the Americans by their boring may expose the bloody loot of Captain Kidd who is known to have frequented these sparsely populated islands and made them his cache.

There were new American water tanks built on timber stilts in defiance of hurricanes. I could not help ribbing my friend about their incongruity. The natives build their rain water catches from a plan tested over three hundred years—wide, flat, and partially in the coral itself, with ventilation and a bug-snapping goldfish in each.

The vast influx of tourists who formerly flooded the island have been supplanted by American soldiers, Highlanders, sailors of the Allied Forces, stevedores, censors and other war workers.

RENDEZVOUS

Horses and bicycles are still the principal means of locomotion in Bermuda. However, the island has been forced by military necessity to grant limited privileges to the automobile which was heretofore so rigorously excluded.



Bermuda keys which formerly swarmed with tourists are now crowded with the soldiers and sailors of America and its allies.

The colorful farewells of sailing time are past. Black painted transports and freighters glide warily out to sea 'twixt dusk and dawn. The families of navy workers and soldiers have been shipped and flown to the mainland. The few American ladies remaining do their bit as censors, stenographers and secretaries in the offices of military and construction organizations.

Bermuda is doing everything in its power to make life pleasant for soldiers and sailors. Bermudians organized clubs with teas, canteens and dances long months before America's entry in the war. Nearly a thousand good ladies have contributed from five to fifty hours a week of voluntary service, providing information, picnics, sightseeing tours, bridge parties, snacks, entertainment and home hospitality.

When a Spanish refugee ship eased alongside the quay after four weeks at sea, the news buzzed over the islands. Like magic people came with baskets of fruit, eggs and delicacies. Organizations sent trucks of food and clothing to alleviate the needs of the unfortunate passengers. The children were feted with an island picnic by Bermuda ladies who chartered a boat and provided toys, food and bathing togs.

One thousand passengers were crowded on a ship with stateroom accommodations for fifteen and not a porthole in the hull. They were boxed in the unventilated hold or curled on deck, privileges for which they paid from several hundred to a thousand dollars. Life boats were filled with mattresses and canvas hung over the booms for protection from heat and moisture. The commander's first request was an immediate and unlimited supply of fresh vegetables and fruits, specifically 15,000 oranges—just when Bermuda markets had none.

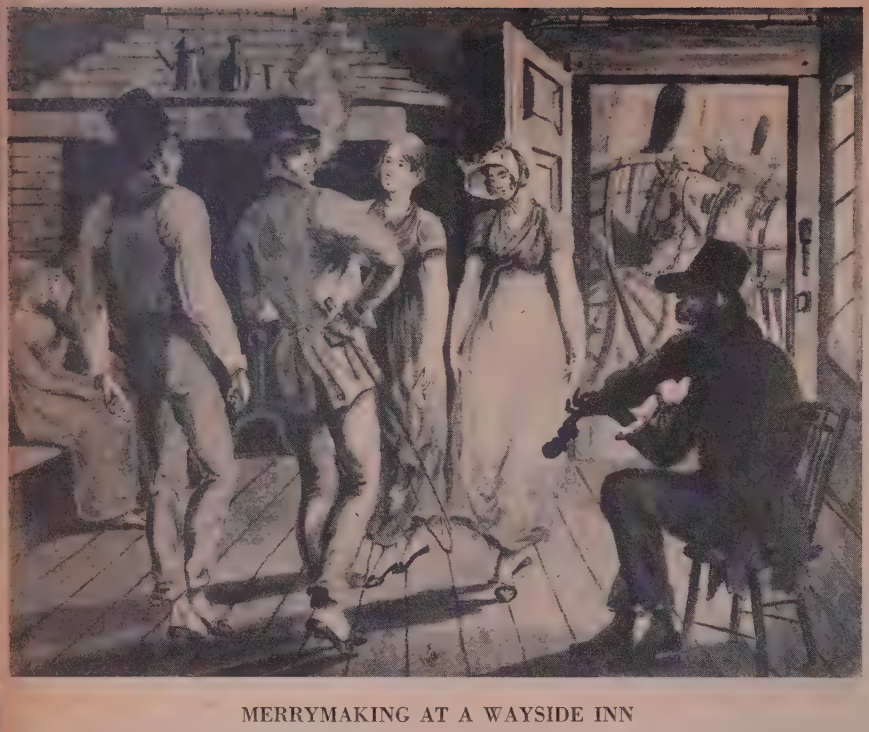
"Tell your people that America's Bundles for Britain were a gift from heaven", said Dickie Tucker, founder of the British Sailor's Home in Hamilton. "When the torpedoed crews commenced landing here they could be clothed immediately."

The Sailor's Home has housed seamen representing eleven nations. Sometimes when a ship has been sunk survivors fill the dormitory and sprawl over the bil-

(Continued on page 34)

CZARIST RUSSIA VISITS AMERICA 1811-1813

Courtesy of the Metropolitan Museum of Art



MERRYMAKING AT A WAYSIDE INN

Like so many visitors to America in the early nineteenth century Svinin was fascinated by the wayside inns and the kind of entertainment which they provided for travelers. Apparently inn keepers were a notoriously inquisitive group. It is said that Benjamin Franklin forestalled their questions by saying, when he entered an inn, "My name is Benjamin Franklin. I was born in Boston. I am a printer by profession, am traveling to Philadelphia, shall have to return at such a time and have no news. Now, what can you give me for dinner?"

THE American scene of a century and a quarter ago as it impressed a European traveler is strikingly presented in these water colors from the brush of one of the earliest Russian visitors to this country. From 1811 to 1813 Paul Petrovich Svinin spent some twenty months in the United States, ranging from Maine to Virginia and occasionally recording what he saw in water color. The portfolio of his work lay neglected or lost for almost a century, until shortly after the Russian Revolution, when it was dramatically discovered by an American Red Cross worker.

A diplomat, journalist, and man of parts in general, as well as an artist, Svinin found much that appealed to him in the New World. He made use of subjects that often escaped the interest of native artists too familiar with their own street scenes. A religious meeting of frenzied Negroes, a night scene showing an oyster barrow before Philadelphia's old Chestnut Street Theater, Moravians, Friends, Osage warriors, and the immersion rites of the Anabaptists all attracted his brush. Views of the countryside and such natural wonders as Niagara Falls and Natural Bridge also claimed his attention. In his writings Svinin revealed an intense interest in the steamboats, "floating towns" as he called them, which were starting to appear on American rivers.

Svinin received a formal art education at St. Petersburg, and his sketches are colorful and capably drawn, frequently showing a talent altogether unusual for the place and time. His comments on America, which were published in Russia upon his return, provide a brilliant and illuminating commentary on our country when it was young.

SUNDAY MORNING IN PHILADELPHIA

Svinin was much interested by the Quakers and their influence on Philadelphia life. On Sunday, he said, "one meets in the streets of Philadelphia only gloomy faces, the faces of people sunk in meditation, and does not see a single smile — it is as though the city were in mourning."

NEW YORK CITY FROM WEEHAUKEN

Svinin believed in the promise of American life. "The United Ame
States present to the observer an example unprecedented in the a
of history," he wrote. "The Americans have shown themselves
worthy of enjoying those rights of true liberty and happiness, the
foundation of the spirit of their Government, which, to my mind, e
in this respect all the ancient and modern republics."

WORLDLY FOLK

Here Svinin pictures a wealthy Philadelphian couple questioning two chimney sweeps and their master before Christ Church. The Russian artist felt that all the States of the Union would soon follow example of those northern states which have already freed their Negro slaves.

INDIAN HEADS

in sketched these Indian types
life. He likened the periodic
gation of Indians to Washington
he embassies of the old Tartar
s to the Russian Czar as being
y inspired by the desire for
rich presents.

ON THE HUDSON

This is probably a picture of the *Paragon,* one of Robert Fulton's steamboats. Fort Putnam and West Point are seen in the background.

RIDING THE RAPIDS OF THE Grand Canyon

By WELDON F. HEALD

"IF we hit that big hole *church will sure let out!*"

I looked for the usual twinkle in Norm's eyes, but it wasn't there. His mouth was a grim, straight line; his eyes straining ahead to the wild, thundering water of the approaching rapid.

"Here we go," he shouted, digging in his oars. "Hang on like hell!"

I did. Flattened, face down, on the cramped deck of the sixteen foot cataract boat I clutched at the safety ropes.

The boat softly slid down the smooth tongue of the rapid—then shuddered, hesitating. All at once the world became a roaring, watery inferno. The half ton boat was picked up and hurled forward, plunging and rearing. From its heaving deck I had confused, kaleidoscopic glimpses of twenty foot explosion waves geysering above us; split second flashes into wicked-looking holes guarded by curling walls of foam; fleeting views of yawning whirlpools spinning by.

A few drenching, breathless moments in a swirling fury of water—then it was over. The sturdy boat shot out below the rapid, staggering like a punch drunk fighter, its cockpit half full of water. Norm started bailing.

"We were lucky," he said. The twinkle returned to his eyes.

I looked back to the raging maelstrom we had somehow managed to come through. It was the first. There were two hundred more rapids waiting for

WATERFALLS IN THE GRAND CANYON

After every storm hundreds of waterfalls pour down precipitous sides of the Grand Canyon. At one time the expedition counted between twenty and thirty falls 1500 to 2000 feet high. Desert storms come up with tropical suddenness and to anyone camping along the river banks they may be a source of danger. Camp sites must be chosen with great care because of the possibility of flash floods which may sweep all the equipment into the river.

Weldon F. Heald

Weldon F. Heald

IN THE MAELSTROM

Superb skill, steady nerves and courage enabled Alexander E. Grant Jr. to bring his fragile kayak through the two hundred treacherous rapids of the Colorado.

Wm. J. Schukraf

THUNDERING WATERS

The cataract boats used by the expedition were sixteen feet in length and specially designed for shooting the perilous rapids of the Colorado.

us below. Would our luck hold out?

We were going to need plenty. Shooting the Colorado River in high water was an adventure which only eighteen people in the world had experienced before us. All but two of the seventeen previous expeditions through Marble and Grand Canyons had been made in the low water of fall and winter. They met difficulties and hazards, but they did not ride the roaring, tumultuous, summer floods which pour down from the melting snows of the Rockies.

But six of us riding the Colorado flood in two boats and a kayak, buried for three weeks in lonely canyons five thousand feet deep, learned that danger can be fun.

"The Colorado makes the rules—you just play the game."

It was Norman Nevills who taught us that.

Norm lives up on the San Juan River at Mexican Hat, Utah, where he has a private navy of eighteen boats. Boats are his life, rivers his religion. They are in Norm's blood. At thirty-three, he has already run five thousand rough-water miles on Western rivers with a record of never upsetting a boat.

But Norm's great love is the Colorado. He has studied the River for eleven years, read all that has been written about it twenty times over, shot every rapid along its length from Wyoming to Boulder Dam. Reasons enough why the rest of us had confidence in him. It would be hard to find a better leader than Norman Nevills.

Dell Reed, Norm's neighbor from Bluff, Utah, handled the second cataract boat. Dell is another old hand at running rapids, having learned the technique on Norm's two previous trips down the River in 1938 and 1940. Dell, too, has been bitten by the Colorado River bug, but he still protests.

"I wouldn't do this for anybody but Norm," he declared, "and I'm damned if I know why I'm doing it for him."

Our third boat, the kayak, was piloted by Alexander E. Grant Jr. He didn't know the Colorado, but he had run miles of "white water" in everything from barrels to foldboats. He arrived from Dedham, Massachusetts, jauntily carrying the dismantled kayak in two suitcases. The rest of us were very kind to Zee Grant before the start. We regarded him as a brave young man who had picked the wrong river.

Agnes Albert from San Mateo, California, William J. Schukraft of Chicago and I were green hands. Crew when we knew what to do, passengers when we didn't, in the major rapids the three of us degenerated into nothing but *hangers on.* Agnes is the fifth woman to make the Colorado successfully.

Nevills' 1941 Colorado River Expedition pushed off from Lee's Ferry, Arizona, one mid-July morning on its four hundred mile journey to Boulder Dam. Norm and Agnes led in the "flagship", *Wen,* Bill Schukraft, Dell and I followed in the *Mexican Hat II* while Zee Grant had his kayak all to himself. W. E. N. were Norm's father's initials, but the II attached to our boat looked ominous. I never dared ask what became of the *Mexican Hat I.*

For the first few miles we floated lazily down ever deepening Marble Canyon. The two cataract boats proceeded at a dignified pace as befitted old timers. They had been there before. But the kayak, like an inquisitive dachshund that has slipped his leash, darted about here and there as if anxious to examine each corner of this strange place.

And it was a strange place. A kayak on the Colorado! All expert rivermen, including Norm himself, shook their heads. The verdict was unanimous. It couldn't be done.

Zee alone had faith. He believed he could pit his skill against two hundred man-eating rapids and come out alive. His frail entry in the Colorado River steeplechase wasn't a kayak, actually, but a foldboat adapted from the popular German light, folding craft. It was a sleek, cloth covered boat, seventeen feet long, two and a half feet wide with about a foot of freeboard. Unloaded it weighed but sixty pounds.

The interior, with the exception of the cockpit, carried a varied assortment of inflated inner tubes and beach balls for buoyancy while sponsons made of huge inner tubes from Fifth Avenue bus tires were strung along each side to give steadiness. Zee carried a tire pump, for there are no service stations along the Colorado which fix flats.

The kayak's first test would come at Badger Creek Rapid, eight miles below Lee's Ferry. Would Zee make it? We thought we knew the answer.

The current rapidly carried us deeper into Marble Canyon. Pink walls rose sheer several hundred feet. Suddenly Dell leaned forward on his oars.

"Listen," he said. "Badger Creek Rapids! Hear it growlin' and mutterin' to itself?"

The roar grew steadily louder. Beginning as a distant guttural murmur it became a continuous lusty bellow, ampli-

fied very many times by the echoing cliffs.

The three boats beached on the left bank above the rapid. We scrambled down the rock-strewn shore to have a look. I was face to face with my first rapid. A more unhealthy spot in which to be in a boat I couldn't imagine. My enthusiasm for the Colorado reached absolute zero.

To run Badger Creek Rapid in high water you have to hit the triangular tongue squarely in the middle—otherwise you get into trouble. To the right the water curls over a submerged rock into a hole fifteen feet deep. On the left is a raging welter of water in which the least that can happen is an upset boat. The catch is that you can't see the tongue from above. You have to guess.

Norm guessed right. Guided by Dell's signals, he brought the *Wen* through. Next Dell ran the *Mexican Hat* down on Norm's signals. There were two down —one to go.

It was Zee's turn.

Norm stood silhouetted high on a boulder ready to signal. Dell stayed by his boat a quarter of a mile below, waiting. Agnes, Bill and I perched above the roaring water, cameras set. Each one of us was convinced that only a miracle could bring the kayak and its pilot through safely.

Zee pushed out from shore in his fragile, blue craft. He paddled slowly to midstream, looking warily ahead. If any human was capable of shooting Badger Creek Rapid in a kayak, Zee Grant was. After winning most of the eastern white-water foldboat championships he descended the Green River in 1939 and in the summer of 1940 ran the Middle Fork of the Salmon, a branch of Idaho's famed "River of No Return." But the Colorado is something else again.

Zee came on, his double-ended paddle dipping rhythmically. Norm, on his rock, signalled with upraised hand: *a little to the right—that's it—hold it—no—no—not so far—pull left!* Norm's hand waved vigorously now: *back! back!*

Zee had slipped too far to the right. He was directly in line with the hole. We could see. He couldn't. The kayak reached the brink. Zee saw his mistake. He backpaddled valiantly, but—too late. The kayak balanced for a moment, tipped forward and plunged into the hole. Instantly it was swallowed up by the angry, surging water.

We stared in helpless fascination at that empty, gaping hole. Seconds that seemed minutes dragged by before the kayak's blue prow rose out of the spouting foam. That broke the spell. Norm shouted something that was drowned in the roar of the rapid, Bill started down the shore, leaping from rock to rock, in an effort to join Dell who was pushing out in the *Mexican Hat*. For the kayak had shot to the surface—upside down! It hurried through the giant waves, bounding and swaying, but there was no sign of Zee.

A quarter of a mile below a black dot appeared bobbing in the rough water close to the fleeing kayak. Dell, straining on his oars, hadn't a moment to spare. A rope whipped out from the *Mexican Hat*, the black dot merged with the kayak, and we saw with relief Zee astride his upset kayak being towed ashore behind the cataract boat.

When we reached him he was pretty well shaken up, but no more so than the rest of us. The very first day tragedy had come too close!

Zee described later how it feels to travel twenty-five miles an hour under water. Sucked down, mauled, rolled over and over, he was as helpless as a handkerchief in a washing machine. Zee would never have come out alive if he hadn't had presence of mind to press the lever on his spare carbon dioxide life preserver. This shot him to the surface where he had a chance to fight for his life.

One more hurdle, Soap Creek Rapid, remained before we could make our first camp. It was reputed to be bad medicine. Two and a half miles below Badger Creek the River takes off in confused masses of spray, ending a quarter mile below in a series of great, arching waves resembling the wake of a giant paddle wheeler. Norm suggested to Zee that perhaps it would be wiser to line the kayak around the rapid, but Zee shook his head.

"They'd all get me if I quit now," he said. "I've got to run it."

Without another word he studied the rapid, watched the two cataract boats go through, then deliberately shot the kayak down the tongue into the heaviest water, dodging, turning and twisting through the waves with the dexterity of an All-American broken field runner. He landed below the rapid, upright, with a wide grin on his face.

"Will one of you pull the kayak ashore," called Zee. "I don't want to get my feet wet."

That night we camped in a sandy cove below Soap Creek. With the first cup of hot soup the strain of the past few hours dropped away. Taut nerves relaxed. A feeling of elation came over us. We were still six!

We had cheated the River that day. But it was only the beginning. All of us had read Powell, Dellenbaugh, Kolb, Stone, Eddy and the others who had gone down before. From each party the River had taken its toll. In fact, Colorado River literature is grim stuff: strong men crying like babies, wrecked boats, dissensions, desertions and sudden death. The canyon walls are lined with broken oars, mouldering boats, even occasional bleaching bones—mute reminders of those who didn't make it. Hardly an expedition had come through unscathed.

Next morning, like all following mornings, we awakened to the aroma of Dell's coffee. Coffee made Dell's way is a hero's drink; a stimulant suitable for giants about to perform cyclopean tasks. Breakfasts were comfortable, leisurely affairs. Yesterday's rapids were run in retrospect, today's in anticipation, until someone would remember to stir up the driftwood fire and put on the bacon and eggs.

Each day we shot ten to fifteen rapids and each minute the roar of the River was in our ears, a constant warning that we humans didn't belong in that inhospitable land. But no matter how many rapids lay in our path or how hard the day's work we never pushed ourselves to the limit. Lunches followed the same unhurried pattern as breakfasts.

Norm had a practised eye for picking comfortable sites because our noon meal was invariably followed by an hour's siesta. I never understood the sequence exactly: Norm filled us with a "balanced ration", alive with lettered vitamins, which he proudly explained was worked out to give quick energy; five minutes later we were stretched flat, sound asleep.

Fourteen miles was the average daily run. On several occasions, however, we drew upon Norm's energizing balanced ration to do twenty-five or thirty. Our expedition might have broken all speed records, the River being at an ideal stage for making distance with a minimum of rowing. The current, even in the smoother stretches between rapids, carried the boats along at a five to eight mile an hour clip, so we escaped much of the back-breaking, hand-blistering labor at the oars necessary in low water.

Badger and Soap Creek Rapids were samples of what was to be our daily fare. On the second day's run down Marble Canyon the rapids came in quick succession: some big, others small, no two alike but all interesting. Each one had its special thrill.

In House Rock Rapid, like all those of medium size, we ran the three boats one after another without first stopping to inspect. The *Wen* closely followed by Zee in his kayak, was already plunging through the rough water when the *Mexican Hat* slid down the tongue. I was on deck, facing backwards, braced for the first drenching wave when I saw Dell's eyes dilate as if he had seen a river monster ahead.

Weldon F. H

ROUGH GOING

Having passed safely through a twelve foot "hole" Nevills plunges off the tongue of a rapid as he speeds down river. The cataract boats are run through the rapids backwards with the oarsman facing the danger that lies ahead. Sometimes the boats are carried along over the boiling, churning waters at a speed of twenty-five miles an hour.

Weldon F. Heald

TIME OUT

The day's run over treacherous rapids is ended and the kayak and the two cataract boats have been drawn up on a typical sandy beach. Fourteen miles a day was the average distance traveled by the expedition.

"Zee's dumped again!" he shouted.

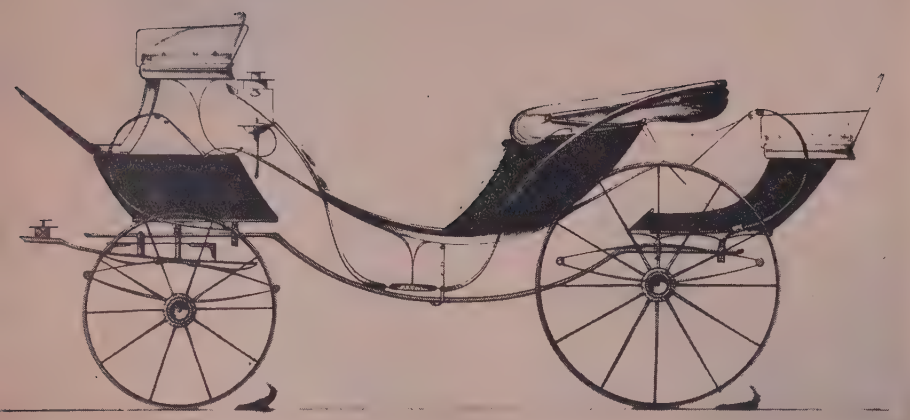
I looked over my shoulder, catching a glimpse of the kayak, bottom side up, riding the wild torrent. An instant later a huge explosion wave slapped me flat on the deck with the force of a fire hose. When I could raise my head once more Zee was triumphantly astride the overturned kayak, calmly paddling to shore.

"That boy's game clear through," said Dell admiringly. "If he doesn't lick the Colorado it won't be from lack of guts."

I agreed heartily, but I knew the success of the expedition depended upon Norm and Dell. Taking a kayak down the River was a spectacular stunt requiring skill and courage, but it would never have been accomplished without the cooperation of a well organized party which included two of the most experienced rivermen who ever shot a rapid.

The real backbone of the expedition was the two cataract boats. The *Wen* and *Mexican Hat II*, twins, identical in construction, were specially designed for Colorado River travel. Sixteen feet long, five wide, they are sturdy, flat-bottomed boats with pointed prows and squared sterns weighing six hundred pounds when empty, double that loaded. Their frames of Louisiana white oak are covered with 9/16th inch marine plywood in single, unbroken sheets. Each boat has seven watertight

(Continued on page 31)



Nineteenth-century America was probably the most ingenious carriage-making country in the world. This Victoria was designed in 1876 by the famous firm of Brewster and Company.

DEEP-SIDED BUGGY.—½ IN SCALE.
Engraved expressly for the New York Coach-maker's Magazine.
Explained on page 178.

This deep-sided buggy is an example of the graceful and efficient designing of America's ablest coach-makers. America invented the buggy in 1826.

From a Lithograph by Horace Vernet 181

The hackney coach appeared in London about 1605 and a little later coaches, or fiacres, were introduced in France. The monarchy devoted much attention to the development of French roads which were so superior to those in England that in 1787 Arthur Young wrote: "We have not in England a conception of such exertion; they are splendid and superb."

LOOKING BACKWARD TO HORSE AND BUGGY DAYS

Photographs Courtesy the Metropolitan Museum of Art

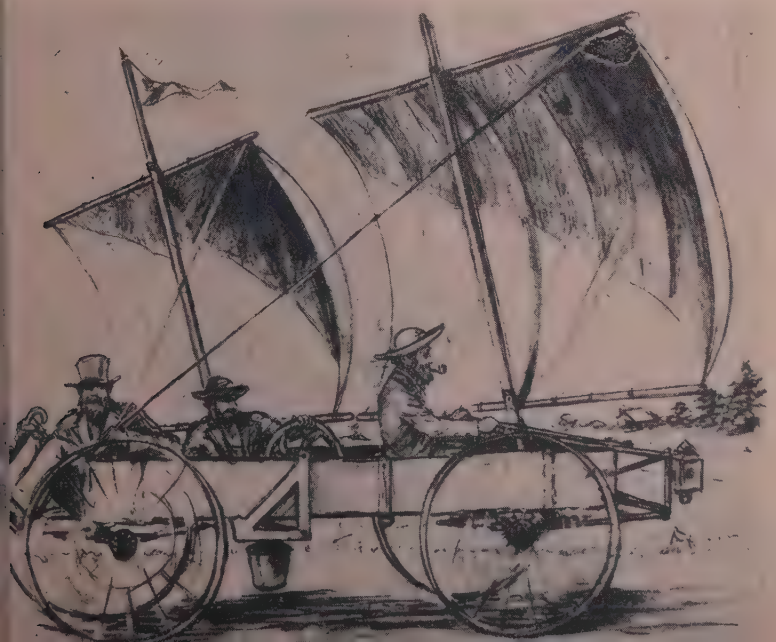
THE days of the horse and buggy seem less remote than they did a short time ago. Old dobbin is no longer the anachronism he used to be, and the methods by which our forebears used to travel now seem to us a trifle less absurd than they once did. Man has depended on a strange and varied assortment of conveyances during the last four or five centuries. Some were awkward and clumsy, some amazingly ornate, some as light and graceful as the skill of master craftsmen could make them. The royal carriage, the hackney coach, the fiacre, the landau, the barouche, the phaeton, the cabriolet, the curicle, the dog cart, the whiskey and, of course, the numerous humble vehicles such as the covered wagon and the "one-hoss shay"—what vivid pictures of the past, its manners, customs, trials and tribulations, these names evoke. Here are a few of the vehicles for which dobbin supplied the motor power. The cumbersome coach of the sixteenth century Italian nobleman and the light, efficient carriages of American manufacturers in the nineteenth century illustrate how slowly mechanical development progressed before the day of the automobile.

* * * *

In the eighteenth century English travelers had to endure every conceivable kind of hardship. Rest at an inn was indeed a welcome relief.

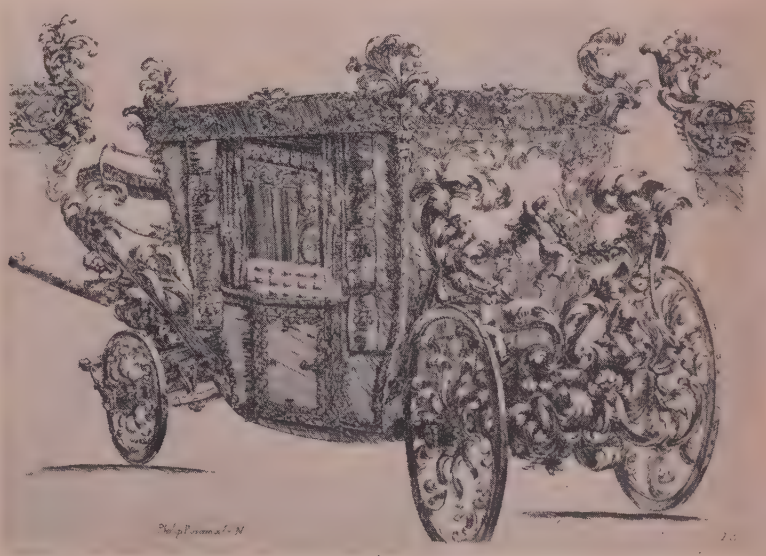
From a drawing by Thomas Rowlandson

fantastic sketch represents an erratic nineteenth century American inventor's of a wind propelled prairie schooner. He thought the horseless age was about to begin.



To the Honourable
RIP VAN DAM. Esq
PRESIDENT of His Majestys Council for the PROVINCE of NEW YORK
This View of the New Dutch Church is most humbly
Dedicated by your Honours most Obedient Servt

This engraving of New York about 1731 shows the coach, or chariot, used by the nobility.



From an Etching by Filipo Passarini 1698

In the seventeenth century the coaches of the nobility, heavily burdened with rococo ornamentation and extravagant baroque, served more for magnificence than convenience.

This design by Marot is a beautiful example of the expert workmanship of seventeenth

Toy trains

THAT CLIMBED THE ROCKIES

By ROSCOE FLEMING

BROWN boys, protecting their eyes with one hand and our modesty with the other, stood naked in the brawling mountain stream that wears, incongruously here, the name of Rio Grande Del Norte. They silently watched our little train rattle by under the fantastically-crested red buttes that confine the river. Farther on, brown people stood stolidly in front of isolated adobe huts brilliant with scarlet festoons of chili peppers. A few miles to one side lay Puye, to the other Taos—organized communities perhaps, when our Anglo-Saxon ancestors were jabbering in caves. Over all brooded the vast sun-drenched ancient land that has impassively viewed the antics of our race for perhaps 25,000 years.

That morning we had crept through the ancient Royal City of the Holy Faith of St. Francis, whence government was being dispensed more than a decade before the Pilgrims landed on the Rock. On either side I could have touched the hollyhocks bending over whitewashed fences, or indeed could almost have patted the cheeks of round-eyed brown children. The little engine tolled its way slowly through the city as if at a funeral, and, indeed, this was the funeral procession of one of America's most picturesque and storied railroads, the narrow-gauge "Chili Line" of the Denver and Rio Grande Western system that linked Santa Fe to the outside world by rail, 125 miles up the Rio Grande valley to Antonito, Colorado.

Ours was the last scheduled trip of the mixed freight-and-passenger train. The system had abandoned the little branch because hardly anyone used it any more: the forests that had kept it busy were all cut down, the mountains were turned inside out and gutted of ore; the teeming livestock were reduced to a few thousand autumn-grazing sheep; and, as for the people, they were nearly all riding in automobiles on the shiny black state highway that parallels much of the little railroad's course. The abandonment left Santa Fe the only state capital not on a passenger railroad line, though the Atchison, Topeka and Santa Fe still carries in freight by rail. And it left 30,000 square miles of New Mexico—a region large as New England excluding Maine—without a railroad.

The bell tolled the requiem, indeed, of more than this one little road's passing. In a very special sense this road stood in death, as it had stood in life, for all the little, scattered discrete narrow-gauge lines that a generation ago counted more than ten thousand miles of busy track; that played a great and vital part in opening up the American West. Whistling shrilly down canyons and around hairpin curves, climbing grades that would have stalled their big brothers of the transcontinental systems, these little trains carried out millions of tons of ore, livestock and lumber, and brought back supplies to cow capitals behind the mountains, and to brawling boom towns of gold and silver. They pushed into the twilight the stage-coach and the six-mule freight wagon and in their turn, their passing almost unnoticed, they have virtually vanished before the truck and the passenger auto. Less than a thousand miles of narrow-gauge track now remain in active scheduled use, and of these, more than five hundred are in the tidy little modern narrow-gauge system that the D. and R. G. W. runs through the mountains of New Mexico and Colorado—of which the "Chili Line" was a feeder.

Painted with loving care, their brasswork polished and shining, their fires drawn for the last time and their vestibules locked, the little trains stand forlornly as monuments to the past glories of Rocky Mountain towns they once linked to the outside world, and whose children once lived for the shrill sound of their whistles. They are becoming as ubiquitous in such towns as are Civil War cannon, with pyramids of cannonballs, in courthouse squares of the Midwest. The ties have gone for fuel, the light rails have gone into the roaring furnaces as scrap metal, the rights-of-way have been taken over by state highway departments. I do not think even the least sensitive person can miss the sadness in the aspect of the immaculate, forlorn little trains. It's hardly fair to call them toys, for they did great and arduous work; yet it was their toylike aspect and their miniature charm that first endeared them to the nation seventy years ago.

Their story is but a chapter in the mighty saga of American railroading; but it is a long chapter, full of picturesque incident and legend and including the bloodiest railroad war of history. On the Rio Grande and Western, the engines and cars were named from the first, and the names roll off the tongue like Homer's, or Masefield's "Catalogue of Ships." The D. and R. G. W.'s first engine, built by Baldwin in 1871, was the *Montezuma*, and officials of the modern system swear heartily when they recall that the *Montezuma* was long ago sold for junk, for about $400. Then there was the *Tabi-Machi*, which pulled the first passenger train that tooted shrilly and proudly from Denver toward Colorado City in August of 1871. Other early locomotives were the *Cortez, Ouray, Ute, Del Norte, Arkansas, Raton, Spanish Peaks, Chicasco, Sangre De Christo, Alamosa, Trinchera, Mosca, Pike, Greenhorn, Hardscrabble,* and *Mountaineer.* The latter was double-ended, to save building turntables high in the mountains, but chuckling legend said it was hinged in the middle to enable the engine to turn the sharp mountain curves—a legend that has become sober reality in the two-hundred foot articulated Diesel electric monsters of today.

The father of the Rio Grande, General William J. Palmer, was also the father of the extended narrow-gauge systems. He was an engineer, a dandy, a diplomat, a promoter, and almost a genius. After his retirement, he built himself a huge fabulous castle, Glen Eyrie, that still stands in a box-canon near Colorado Springs. Sick of chimneys and of train smoke, he had a tunnel bored up hundreds of feet through the mountain back of the mansion to carry off the smoke of his fires.

Born in Pennsylvania of Quaker parents, Palmer built railroads for the Union during the Civil War, and then came West and continued to build. He superintended construction of the Kansas Pacific into Denver. He quit this job with the expressed intent of building a little railroad somewhere which he and a few friends could construct, own and operate.

From Glorieta Pass in New Mexico, five hundred miles to Wyoming, there is essentially one mountain mass rising to 14,000-foot peaks, which, like a great bastion, has always split westward travel which flowed around it. Palmer examined this perpendicular terrain with an engineer's eye and became convinced that at only one point, if at all, could it be pierced with the massive long standard-gauge equipment. He thought of narrow-gauges, that could skip like goats up the canyons and climb mountain walls. His immediate model appears to have been the Festionog, a famous Welsh railroad with a gauge of but two feet—the

THE GEORGETOWN LOOP

At one time excursion trains carrying hundreds of awed passengers passed daily over this famous loop, one of the most remarkable constructions of boom mining days. The road was abandoned in 1939, the tracks removed and the high trestles torn down.

The Denver and Rio Grande

Mountaineer was double-headed so that it
uld not be necessary to build turn-tables in
high mountains. Humorists insisted the
ine was equipped with a hinge in the center
that it could negotiate the very sharp switch-back curves.

This high trestle is typical of many structures built to carry the narrow gauge trains over deep valleys and canyons.

Thos. J. Barbre

George N. Burkhardt

"Old No. 71" of the Colorado and Southern is on permanent exhibition at Central City. The queer gadget above the smoke stack is a cinder catcher which was used to drop cinders on the right-of-way and prevent grass and forest fires.

TO THE TOP OF THE ROCKIES

This narrow gauge double-header is starting the long climb over the Continental Divide at Marshall Pass, 10,856 feet above sea level, then and now the highest transcontinental railroad traverse in America. This railroad was one of the most spectacular achievements of the Denver and Rio Grande, opening in 1880 the railroad outlet to western Colorado and Utah.

Denver and Rio Grande

passengers rode back to back as in a jaunting-car. His imagination kindled. Forgotten was the modest little railroad of his dreams. If the standard lines could not penetrate the mountains that were bursting with gold and silver, the narrow-gauge could become the key link in the transportation scheme of the whole continent. He foresaw the major railroads bringing their burdens up to the mountain barrier and humbly laying them down to be carried across by the nimble, mountain-climbing narrow-gauge. He envisioned a system that would reach from Seattle to Mexico City, and gird the mountains between.

If Palmer had been right, instead of only partially right, Harriman and Hill would have been minor figures beside him. And if his dream now seems fantastic, recall that about this time men were discussing a line to tunnel under the Straits of Bering and link New York to Petrograd and thence to all Europe by rail; and that in 1889 the president of a prospective railroad, Frank Mason Brown, was drowned with several of his party while running the Grand Canyon to locate a place to hang a railroad on its mighty walls.

Palmer found money easy to raise. G. L. Anderson, historian of the D. and R. G. W., writes that it was unique in being built "without federal subsidy or land-grant, through an unpopulated and undeveloped region, in a period when construction was costly and when fear and depression gripped the money markets of the world."

Palmer decided on a gauge of 36 inches, as against the standard of 56½. Construction was begun south from Denver on Jan. 1, 1871. The first rails were imported from England and Belgium.

On August 14, 1871, the *Tabi-Machi* screamed shrilly and proudly ahead of a trainload of notables. The nation watched. The little road had caught the public fancy, and became known as "The Baby Railroad of America." Denver was particularly hard hit by the narrow-gauge craze.

"The people of that city became so obsessed with Palmer's logic that they had narrow-gauge on the brain; they ate narrow-gauge hash, drank narrow-gauge whiskey, played narrow-gauge poker, and a burro was known as a narrow-gauge mule," wrote a later chronicler.

Palmer, an excellent publicity man, daily found new virtues in the narrow-gauge. Why, he said, a narrow-gauge sleeper would be even more comfortable and safe than the standard style, for it would not be so wide as to allow a sleeping passenger to roll dangerously with the movement of the train. Answered a contemporary newspaper paragrapher, drily: "All those who have survived a night on a narrow-gauge Pullman can corroborate the General. None but those built like beanpoles could get into the berths at all, and then only by lying edgewise."

The first passenger cars for the D. and R. G. W. were built by Jackson and Sharp of Pennsylvania. They were thirty-five feet long, seven feet wide overall, ten and one-half feet high; the wheels were two feet in diameter. The single seats were nineteen inches wide, the aisle seventeen; then across the aisle were "double" seats thirty-six inches wide. Double and single seating arrangements were reversed at the center of the car, to balance passenger-weight around curves. The cars weighed 15,000 pounds, and passenger-capacity was 36. These statistics help explain the protest at cramped berths. Heat came from a coal stove located at each end of the car—the "Chili Line" cars, in 1941, were heated in exactly the same way! Billmeyer and Smalls of York, Pa., built the first flat freight-cars. They were 23½ feet long, 6 feet wide, weighed 6,250 pounds each and had a rated capacity of ten tons. Box cars likewise were rated at ten tons, and cattle cars carried nine cattle.

The *Montezuma* and its brethren weighed about twelve tons; the freight engines from fourteen to eighteen. These engines burned coal, and did not have the flare-stacks of the Eastern wood-burners.

But later mountain-types, such as the *Mountaineer*, did have flare stacks, and one Colorado community refused to take a *Montezuma* type engine unless "the original flare stack" was restored. The railroad, always anxious to please, built one on.

Howard Fleming, in "The Narrow-Gauge Railroad in America," published in 1876, estimates that in that year some twenty narrow-gauge systems had been built or were building, on the plains as well as in the Eastern and Western mountains. On the flat lands they were of little use, for in cost and men it was as expensive to operate a little train as to operate a standard one that would carry many times the tonnage and people. The Denver, South Park and Pacific for a

time charged $29 a ton for freight from Denver to Leadville—a distance of 150 miles. This charge for freight was higher than from New York to San Francisco around the Horn. The sole virtue of the narrow-gauges was adaptability to the mountains. Fleming said some of the D. and R. G. W.'s original curves were as narrow as 19 degrees, or of 302 feet radius, and the original grades rose in places more than 200 feet to the mile.

Palmer never got to Mexico City, or even to El Paso, though later as a separate enterprise he built a line in Mexico. His charter said he must go south through Santa Fe. Thence he directed his young railroad via Raton Pass. But an older, more powerful and wealthier system, the Atchison, Topeka and Santa Fe, headed there too. When Palmer's work gangs neared the Pass, they were confronted by parapets bristling with Santa Fe riflemen. So he headed for the New Mexican capital obliquely, over the 9,400-foot La Veta Pass, thence into the San Luis Valley, the first large valley of the Rio Grande. It took Palmer fourteen years to reach Santa Fe, via the "Chili Line," partly because he spent much of that time fighting for his corporate life.

The one partial exception to the rule that there is no gap through the mountain-mass is the Royal Gorge, the frightful red gash which the Arkansas River has gnawed from its mountain birth-place to reach the plains. Palmer had his eye on this gorge for his westward extension.

Gold had been discovered high in the Arkansas Valley, above the Gorge, in 1860, and Oro City had been established there. The gold camp faded out, but finally someone in Oro City had the gumption to have an assay made of the heavy black sand that the miners cursed, and it turned out to be lead-silver carbonate worth $400 a ton. Within a few months the camp, rechristened Leadville, was a roaring metropolis of twenty thousand people, dependent for every pound of food and supplies, every shipment of the silver pigs, upon freight wagons that charged $18 a ton to Colorado Springs.

The Santa Fe and the Rio Grande were already fighting for the Gorge, and, before the silver discovery, Palmer had in a fit of depression leased his whole line to the Santa Fe. Then came the silver boom, and Palmer's tenuous "baby railroad" became suddenly a very precious child indeed. He went East, raised $7,000,000 and began suit to break the Santa Fe's lease.

Meanwhile, he sent his chief assistant engineer, James R. de Remer, to hold the Gorge for the Rio Grande by force.

De Remer's men rolled boulders over the rim to boom down two thousand feet and burst like bombs on Santa Fe work-

A DOUBLE-HEADER

s photograph of a ble-header on top La Veta Pass was en about 1890 by liam Henry Jack- one of America's test pioneer pho- aphers. La Veta s was the route sen by William J. mer when riflemen ed by the rival ta Fe prevented from building young railroad ough the more con- ient Raton Pass.

ers. Aided by this diversion, his forces climbed down over the rim to the bottom above the point reached by Santa Fe parties, and forted up. The Santa Fe put a price of $10,000 on de Remer dead or alive. It was never collected. Men on both sides were killed or wounded by rifle-fire. When the Santa Fe reached the deadline established by de Remer, he stepped out with a rifle and warned: "Stop at your peril." A Santa Fe workman who had been about to carry a tie across the deadline turned back and said to his foreman: "If you want that tie across there, take it yourself!"

The foreman didn't.

Meanwhile Palmer, armed with a court order obtained in Denver, was storming the buildings of the line all the way from Denver to Pueblo, bursting in barricaded doors with rams made of telegraph-poles, throwing out the Santa Fe men and installing his own.

The financiers in the background chafed at the expensive war and the rich business meanwhile going to waste.

So in 1880 a treaty of peace was signed in Boston. The Santa Fe was not to build to Leadville or Denver. The D. and R. G. W. was not to build east or to El Paso. Gone was Palmer's dream of Mexico City. But he still had Leadville, and after his first train to that city brought General U. S. Grant amid a storm of cheers, his line went on to Utah via Marshall Pass, 10,856 feet in altitude, then and now the highest railroad pass in the country.

His system had 1600 miles of main-track, and every mile was originally narrow-gauge. But the toylike equipment, despite its agility in the mountains, simply could not compete with standard-gauge. First Palmer triple-tracked from Denver to Pueblo, and the road's engineers perfected a swinging couple, enabling both narrow and standard gauge cars to be handled in the same train. There are many miles of this triple-track left in the San Luis Valley. Eventually the whole main line was widened, and the narrow-gauges it left to one side constitute the modernized narrow system of the D. and R. G. W.

Meanwhile narrow-gauges were built in Maine, Pennsylvania, Michigan, West Virginia, Nevada, but always first and foremost through the Rockies, and especially where gold and silver strikes promised business. The Denver, South Park and Pacific was built over lofty Boreas Pass and into Leadville by the back door, almost before the D. and R. G. W. got there. Otto Mears built all through the mountains of Southwestern Colorado. The Colorado Central was built up the crooked steep-walled Clear Creek Canon west of Denver to the then famous and bustling gold and silver camps of Black Hawk, Central City, Idaho Springs, Georgetown and Silver Plume. Denver to Georgetown used to be an overnight trip by Pullman. Today Georgetown is just forty-six miles from Denver over a broad, safe, dustless highway. Idaho Springs, which was then almost as hard to reach, is just thirty-four miles. There, in a few words, is the epitaph of the narrow-gauges.

Above Georgetown was the famous Georgetown Loop, a sort of reverse double switchback built over nothing. Years ago, a train crew thought the trestle unsafe after a cloudburst, and wired Golden for instructions. The distant, and safe, dispatcher ordered them to proceed. So the crew walked across; the engineer set the throttle for five miles an hour and stepped off; the train went across unattended; the fireman stepped on and stopped the train to wait for the engineer, who then walked across.

There was always something picturesque and unprecedented happening. Near Durango an engineer did not see that a flash flood had washed out a trestle over a ravine—leaving the ties and rails hanging over nothing—in time to stop until the engine was half its length out on the structure. Then—nothing happened! The ties and rails sagged like a tight wire, but they held up the engine until it was cautiously dragged back.

A few years ago a flash flood washed out seven miles of the Colorado Central above Golden, and all the little engines were in the roundhouse there, bedded down for the night, with none above the break. So one of the engines was hoisted on a monster highway crawler, which carried it up into the mountains to a point above the break, and set it down with, as it were, a loving spank on the tender.

But the legends cluster thickest around the Chili Line—I think by a sort of process of transfer. It was of this line that Bye Hutchins told his wildest fables. Yet if you were to mix fact and fancy I would defy you to distinguish between them. Bye said that the curves were so narrow the engineer used to borrow the conductor's tobacco, reaching across to the caboose on one curve, and then hand it back on the next. Now, despite the fact that the Chili Line—which descends from the 7,000 of Santa Fe to about 5,200 at the river, and climbs back up to 9,000 feet before it reaches Antonito—goes down to the river by a series of switchback curves so short and steep the traveler feels as if the train were using a stepladder; its curves really are not as tight as some elsewhere. But over near Chama, also on the narrow-gauge, is a curve a mile around and about seventy-five feet across the neck, so that trainmen desiring to go up to the head-end can step off the caboose, stroll across the neck of the curve, and sit down and wait leisurely for the laboring little locomotive to bring the train up and around to them. It is one of Bye's inventions that the fireman broke the headlight by throwing a scoopful of coal into it, mistaking it for the firebox on a curve.

It is a fable, also, that the agent at Espanola, New Mexico, where passengers transferred to stages to visit the mighty ruins at Puye, used to assert he knew the train was coming when he saw the engineer's dog coming down the tracks.

But it is not a fable that when the engineer coughed his false teeth out the window on Embudo Hill, he stopped the train. Then crew and passengers hunted for the teeth until they were found, after which he sped up a trifle and brought the train to Santa Fe on time.

Nor is it a fable that a Chili Line train once plunged down Embudo Hill's four-percent grade running wild. The driving-rods had broken and were thrashing like flails of death. A brakeman who had gotten on the cowcatcher just sat there, rigid with terror. The fireman jumped, the engineer climbed far back on the tender. The train roared down at seventy miles an hour; slowed, and came to a stop on the level right at Embudo station, as precisely as the engineer could have stopped it.

Nor is it a fable that in recent years, the little train punctiliously stopped at each farm of the hardy pioneers who were trying to colonize the great pinion and sage uplands, and filled barrels spotted in front of each farm with the precious gift of water, so that the colonists would not thirst to death. Nor that the train would stop for hitchhikers, if they looked as though they could pay a fare. Nor that passenger-coaches each had a little parlor-style bow-window built out from the sides so that the brakeman could get a quick look out. Nor that the cupola was on the engine-tender instead of the caboose. Nor that the engineer punctiliously delivered the latest papers to a remote ranch house by tossing them to the ranch dog, which picked them up and carried them to the ranch house.

There are five hundred miles of narrow-gauge left out West: Alamosa to Salida and Durango, all in Colorado; and to Chama and Farmington in New Mexico. Passenger service is still available over part of this route, through some of the most gorgeous high-piled mountains in America, where deer lift up their heads beside the streams to gaze with soft-eyed indifference at the familiar spectacle of the little train puffing and panting its way through the mountains.

AMERICA'S NEW

WILD LIFE

INDUSTRY

By ROSS L. HOLMAN

Illustrations courtesy State of Tennessee, Department of Conservation

ABOUT TO GRADUATE

Thousands of wild life farmers throughout America are raising quail, and the government gladly cooperates with them for they are making a valuable contribution to conservation. This youngster is growing up at the Tennessee Game Farm near Knoxville.

PLAYFELLOWS

Nowadays farmers, nature lovers and conservationists are raising birds and animals of many kinds. Many states have found wild farming is actually a paying venture and on their reservations you will find a surprising variety of creatures growing up happily under intelligent, scientific supervision.

A FEW YEARS ago a prosperous business man in one of our Eastern states took on a hobby of raising pheasants. The pheasant, as we all know, is one of our most important game birds and we usually associate it with all-day hunting, swamp slushing, fence climbing, face scratching and quick trigger work at the right time. But a few years ago some enterprising souls started raising this wily bird in their own backyards and among these was the Eastern business executive.

This new type of poultry farming became a fascinating diversion and provided an escape from his business worries. He started dressing his birds and selling them to cafés, hotels and other public eating places. He found the demand so abnormal he sold out his main business, lock, stock and barrel, and is now making $25,000 a year from his pheasants.

While this business man's experience is an exceptional case, it is part of the story of a vast new industry that is shaping up in this country. Wild life farming is a growing business activity that opens new opportunities, both for producers who wish to raise the game, and for salaried game technicians to show them how.

Primarily, however, the main premise upon which wild life farming is promoted is not to raise game for immediate consumption, but to restock our game lands and save the shy creatures of our open spaces from ultimate extermination. The chief market for all that is produced for this purpose is state conservation commissions, private hunting clubs and other game breeders. Many states do not allow sale for consumption but, if allowed, domestic production for this purpose does not interfere with the preservation of game in the wild.

Squirrels are delightful and ingratiating creatures, full of fun and mischief. This nimble fellow knows just where to go when he needs a drink of water.

The Lady Amhurst pheasant has a long brilliantly colored tail. This handsome creature belongs to the Tennessee Game Farm.

The Tennessee Game Farm and the State's special game preserve cover seven thousand acres. Here are some of the brooders and holding pens in which quail and pheasants are raised.

Quail that grow up in captivity become very tame. Both quail and pheasant are handled like chickens but they cannot associate with them.

Some farmers now have white tail deer roaming through their woods and pastures.

While game birds and animals have been raised under domestic conditions for many years the business took a tremendous spurt with the passage of the Robertson-Pittman Act which went into effect July 1, 1938. Under this law individual states that pass the necessary cooperative legislation may secure access to certain federal funds to promote production of wildlife in its own borders. Practically every state in the union is now cooperating in this program.

There are thousands of wildlife farmers in this country who are raising quail or pheasants. Production of game birds has even become a widespread 4-H Club activity. Over in Washington County, Tennessee, the entire Boone's Creek district of seven thousand acres has been set aside as a game preserve and 4-H boys and girls are raising in their own brooders a good part of the quail to restock it. One fourteen-year-old boy got one-hundred-day-old chicks from the state game farm and raised seventy-nine of them for release. Another took a smaller lot of baby quail and raised thirty; another twenty-five, and so on. The state conservation department furnishes specifications by which a youngster can make his own brooder and equip it with a purchased heating unit.

Before action was taken by the federal government to preserve its game supply many classes of birds and animals that once romped over our forests and plains had gone the way of the buffalo. Some of them went that way first. As land cleared, wildlife vanished. Trees, jungle and undergrowth gave way to cornfields and skyscrapers. The job of extinction has been hastened by the annihilating accuracy of our modern firearms.

The person who pioneered quail production in this country before anyone dreamed such a job was possible was a teen-age boy who found a batch of quail eggs and hatched them under a bantam hen. He later showed a brood of nineteen lusty bobwhites at his local fair. That boy was W. B. Coleman.

Young Billy Coleman became so fascinated with the possibility of growing these birds in his own yard he continued the work, studied methods of feeding, artificial brooding, and learned to cope with some important diseases that brought him devastating results.

When wildlife conservation first started Billy Coleman was employed by the state of Virginia to take charge of the first state-owned quail farm in existence. That was in 1919. He then hatched and brooded his birds with bantam hens, but in 1925 set up some of the first incubators and brooders ever used for the purpose.

He operated this state farm for ten years and in 1929 started his own quail farm near Richmond, Va., known as the White Oaks Game Farm. During 1931 and 1932 he sold the New York State Game Department 10,000 quail at $2 and $2.25 a head. In 1935 he raised around 33,000. Game farming with him is big business.

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popular.

Coleman keeps his own quail hens to lay the eggs for his incubators, legbands them, and checks their egg-production as carefully as he would that of a pedigreed leghorn. He prides himself on one hen that laid 709 eggs in six consecutive years, when the average production of the bobwhite in the wild is eighteen to twenty eggs a season.

Any one who wishes to give this queer but lucrative type of poultry farming a fling can get in touch with his state conservation department and Bureau of Biogolical Survey at Washington and get all the enthusiastic cooperation and free literature he needs. Quite frequently the state department will send out a game technician to help the new producer off to a right start. Many states furnish free broods of either quail or pheasant chicks if the producer will agree to sell back to them the matured birds for release. State laws covering game breeding differ radically from state to state, however, and any new producer who attempts it will likely run into grief if he does not contact his state game officials and familiarize himself with his local regulations.

Quail and pheasants are handled much like chickens but some of the distinctions are important. They have to be raised away from other premises on which poultry was handled within the previous two years. Lice, mites and other parasites of this nature are quick death to quail or pheasant chicks.

Chicken incubators and brooders can be used, but regular quail machines are best. Billy Coleman has designed a special outdoor brooder that is excellent for raising them. The chicks are carried in the brooder from four and one half to six weeks of age with the temperature regulated as with chickens. Feed worries are now largely eliminated with the special quail or pheasant mashes offered by feed mills. These may be supplemented by green stuff.

Many producers sell their birds for release around six weeks of age. Others carry them on to maturity at twelve to fourteen weeks of age in wire-enclosed holding pens.

While the production of game offers a lucrative income within itself, many landowners, in cooperation with the state, stock their lands and sell shooting rights to sportsmen. One beauty about this type of farming is that the most worthless land can be bought or used for the purpose. Rocky, swampy, cutover areas, or land unsuited to any other kind of farming can be set to bushes, vines and other game covers and used for this purpose. A better day is dawning for the hard pressed land owner when he can take his most worthless land, put on it a crop that needs no cultivation, and sell it to sportsmen who harvest it themselves. If this isn't a break for the farmer, what is?

While quail and pheasants are by far the most popular specimens of game raised in captivity, many other wildlife birds and animals have become a farm activity. Some farmers now have whitetail deer romping over their pastures. Their kennels are not only raising airedales and police dogs, but turning out cute litters of fox and raccoon pups. The wild turkeys that used to be so abundant in our unbroken American wilderness, are now raised in our own back lots, to again take their place in our great forested areas.

The game turkey is raised much like his domestic cousin. The main difficulty about raising a wild turkey is keeping it wild. When grown out under domestic conditions where he is pampered and all feed handed out to him, he becomes soft and tame. The producer shouldn't let

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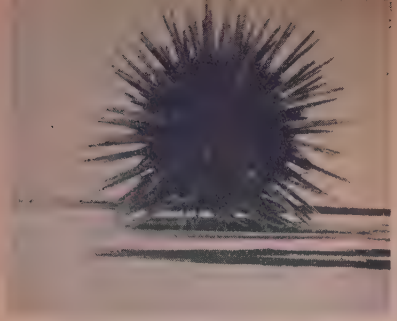
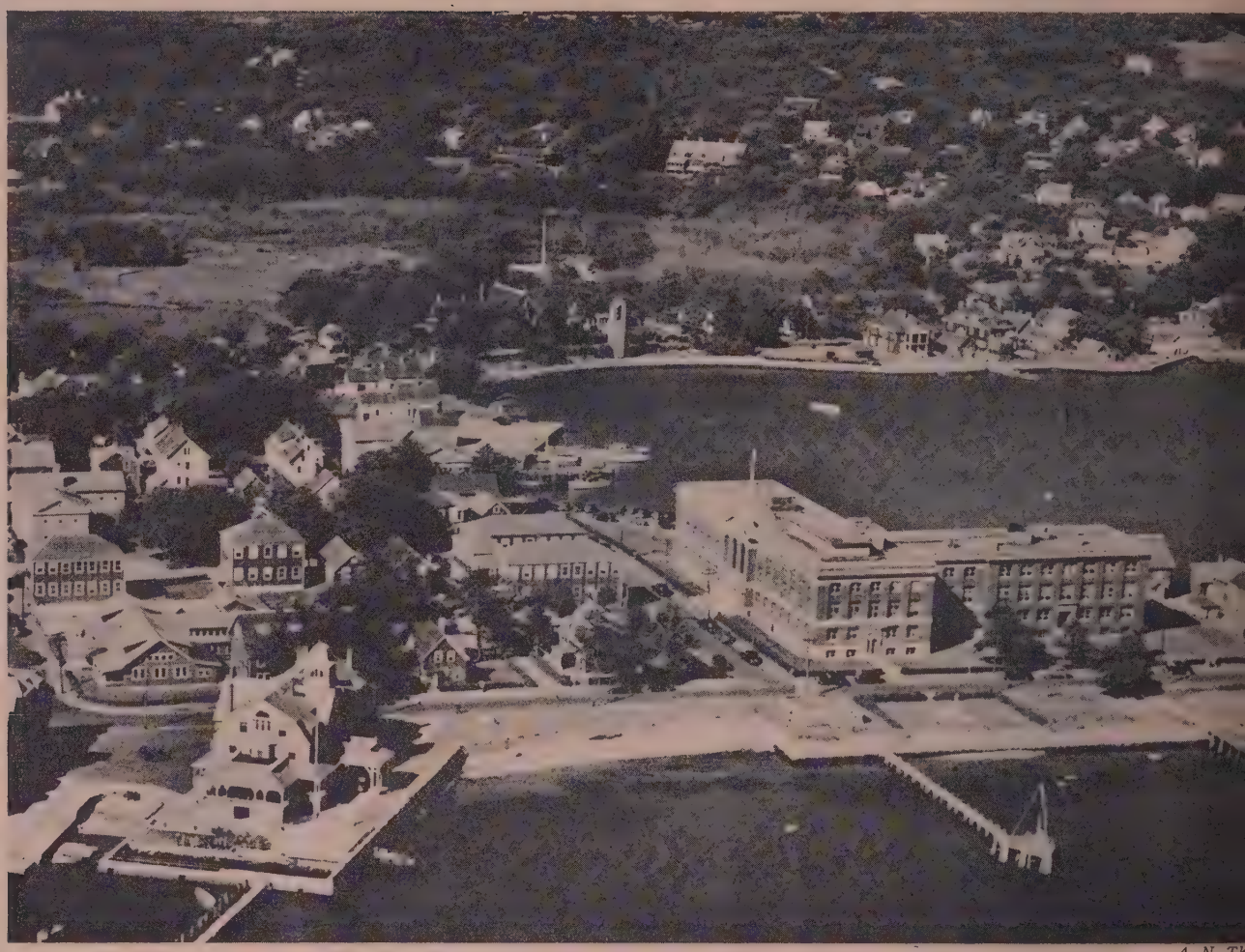


From the eggs of Arbacia, the humble sea urchin, scientists have produced life without fertilization.

TAKING LESSONS FROM THE SEA

By ELON JESSUP

Photographs from the General Biological Supply House, Chicago.



A. N. Th

The Marine Biological Laboratory at Woods Hole, Massachusetts, is one of the most important institutions of its kind in the world. The work that has been done there is known to scientists in every part of the globe.

Both the beginner and the expert find tadpoles a fascinating subject for biological study. The loss of tales and gills and their gradual transformation into frogs is a recapitulation of an important phase of evolutionary history.

THE nervous system of Ensus, the razor shell clam, the variegated colorin of Loligo, the skid, and the tubular feet of Asterias, the star fish, attract a uncommon amount of interest in an unpretentious Cape Cod village.

Then, there is Arbacia the sea urchin. This individual may be a chestnu to handle but on one count alone he has brought fame to the small community In their experiments with the eggs of this creature scientists have discovere that they can produce life without the aid of fertilization. Shall it be twins triplets or quadruplets? A special chemical treatment applied to a single eg will produce any of these results if the scientists so desire.

Investigations into the private lives of these and many other primitiv marine inhabitants may impress you as having slight bearing upon our vita interests and problems. However, in point of fact, they may have a pro found bearing. The science of life is a far-reaching subject. Livin creatures in their varying forms have many things in common.

Complex scientific experiments, long and often dreary research, the tabula tion and examination of innumerable facts, the reading of learned mono graphs bristling with difficult technical terms—all of these activities are ap to bewilder the layman. As he goes through the Laboratory, however, he i bound to be fascinated by the marine life that has been collected and whic ranges from tiny eggs through many species of fish to the large Cumberlan terrapin. Though it may not be clear to the ordinary visitor just what pur poses these creatures serve, he may be assured that they aid us continuall to increase our store of useful knowledge in such widely varied fields as th

fishing industry and medicine. What good purpose, you may ask, can be served by that ugly seashore nuisance, Limulus, the horseshoe crab. A very important one indeed. The heart of the horseshoe crab is used as a basis for the study of the human heart. The ways of science are often devious, but the rewards of work successfully completed are great. For these reasons the Marine Biological Laboratory in the village of Woods Hole, Massachusetts, is an institution of very great importance.

You may wonder why a hitherto unheard of fishing village on the southwestern tip of Cape Cod should have been chosen as a location for this laboratory. Climb up the shore road edging Little Harbor. The railroad tracks below provide part of the answer. Woods Hole is easily reached from colleges and universities in the East and it is not too inaccessible from the South and the West.

Continue climbing to the top of the hill, the seagoing end of a ridge unusually lofty for Cape Cod. Here the forest has been cleared away and the turf smoothed into a rather remarkably situated golf course. A panorama of exceptional beauty discloses further reasons for the presence down below of the Marine Biological Laboratory with its numerous buildings, boats and sundry other equipment comprising a plant that goes down on the books as worth not very much less than three million dollars.

You seem almost completely surrounded by water. Off to the east stretches Nantucket Sound and beyond open ocean, to the south lies Vineyard Sound and the bluffs of Martha's Vineyard only a few miles distant, to the west and northwest stretches Buzzards Bay. Water is everywhere. Water, trees, salt marshes, rocky shores, tide pools, protected inlets, predominately salt water, but curiously enough also patches of fresh. Here and there you will see fresh water ponds, some of them no more than a stone's throw from salt water.

Here is obviously a little of everything. It seems different from the rest of Cape Cod. You are vaguely reminded of a semi-tropical setting. The waters out yonder also are of a blueness and clearness that is distinctive. All this is not without reasons.

New Bedford, the nearest city, is far over across Buzzards Bay with a waterfront that is of interest to the artist but altogether too dirty and smelly to suit the biologist. He is just as pleased it is safely distant. Large rivers with their currents of pollution are even more distant. Thus, the waters surrounding Woods Hole are singularly pure for coastal waters.

You glimpse a rollicking tide running past Woods Hole's front door. At its fastest it can ride at the surprising rate of eight miles to the hour. This is what is called the "Hole." What better flushing agent could a scientist ask? These exceedingly strong tides perform another useful service. They sweep in from the open ocean multitudes of small marine animals and plants, which the back eddies thereupon obligingly deposit in quieter coves and inlets.

A certain amount of this marine life is of tropical origin. The Gulf Stream only eighty-five miles off-shore accounts for that. Much of the rest of the drifting life is of North Atlantic origin because many miles out at sea there occurs a happy alliance of wind and tides. A prevailing southerly wind on one side and an unusually strong tide on the other side combine to funnel the multitudes of marine life from warm and cold climes alike, right in to Woods Hole.

Thus, the long arm of Cape Cod constitutes a dividing line. In Massachusetts Bay only a few miles to the north of Woods Hole you have aquatic conditions similar to those of the Norwegian Sea, while in the waters surrounding Woods Hole the conditions are more comparable to the Mediterranean. Southwestern Cape Cod is the southern limit of many forms of northern ocean life and it is the northern limit of numerous southern forms. Woods Hole gets both. Hence the presence not only of the Marine Biological Laboratory but also an important U. S. Fisheries station and the similarly separate Oceanographic Institution.

What is this Marine Biological Laboratory that has given a small fishing village world wide fame? It is a great many individual laboratories and a number of other things besides. Dr. Frank R. Lillie, chairman of the Executive Committee, defines the Laboratory as a research, teaching, cooperative, national and international institution covering all fields of biology with roots of gradual growth firmly planted in American soil. This is claiming much, he goes on to admit, but one dares not to adventure less.

Not to adventure less appears to have brought abundant results. From a class of eight students, a small frame building and a row-boat as the complete plant to "all fields of biology" and the tremendous scope this term implies represents a considerable achievement, even when spread over a period of fifty-four years. Dr. Lillie goes on to explain that the life of the ocean has proved the institution's greatest asset. But this places no limitations on the use of other biological materials. The cooperative phase also points to a widening canvas. More than eighty universities and other educational institutions now contribute annually to the Laboratory's support. The director is Dr. Charles Palliard of the Department of Cancer Research, Columbia University.

The work of the Marine Biological Laboratory—the MBL, as it is invariably called locally—is chiefly confined to three summer months, although in many instances this may represent only a section of the whole. Much research started here is continued elsewhere during the winter, while some is begun a thousand miles distant and completed in Woods Hole.

The attendance of a summer session will average five hundred, approximately half of this number being independent investigators, chiefly university and col-

es provide excellent subjects for biological re- and so do water snails, one of which is seen right. More than sixty species of water snails been classified by North American scientists.

The Salamander, like its cousin the Newt, is a curious creature. It belongs to the land, but it lays its eggs in water. These youngsters are under observation in the stage before they are ready to leave water for land.

The familiar fresh-water crustacean, the crayfish, tries to look and act like a Cape Cod lobster. When they return inland from their work at sea laboratory workers collect as many of these creatures as possible.

Viviparous fish are always of special interest to biologists. Their young are not produced from eggs but from the female's body as is the case with mammals. These viviparous swordtails came from Central America's fresh water. The one at the right with the prolonged lower lobe of tail fin is the male.

lege professors, many of them prominent names in science. Here in a vacation setting they find the living materials and the most modern of equipment with which to proceed with their research. There are one hundred and fifty-four private research rooms and seventy general research laboratories.

In addition to personal investigation work there is the socially scientific side of this vacation setting. Professor E. G. Conklin of Princeton and also on the Laboratory staff has pointed out its value as follows:

"The service which the Laboratory has rendered to the biological instruction in our schools and colleges and to advanced work in biology in general is incalculable. It is the biological clearing house of this country, where the specialist who has been unable to keep up with the general advance of his science may learn from others what has been transpiring in fields outside his own, where teachers may exchange ideas as to the best methods of instruction, where distinguished men in various fields come to know each other in the most intimate and helpful way and where all may get broader and truer ideas of the great problems of biology."

The student under instruction becomes in turn the trained investigator and then in due time the distinguished leader in science. To this end a number of courses are given comprising the departments of zoology, protozoology, embryology, physiology, botany and radiology. Although in the case of less advanced classes some few college undergraduates of special talents are admitted, it is the graduate students and teachers that predominate. Other marine laboratories are recommended for beginners and near-beginners.

The relations between authority and students in these courses are out of the ordinary. Usual academic machinery is

(Continued on page 34)

There are about 225 species of turtles inhabiting various parts of the world and ranging from our common snapping turtle to the giants of the tropical seas which grow to be eight feet long and weigh a ton. This Cumberland terrapin is a member of the family so highly prized by gourmets.

WITH THE TERRORISTS OF THE HIGH SEAS

(Continued from page 8)

The air arm will argue the claim that subs have caused more destruction than any other type of craft, but these underwater terrorists constitute the most formidable offensive weapon of a fleet, can be used for scouting stealthily off enemy coasts and among enemy warships. They ask no favors from other vessels and take good care of themselves.

Proof that the Allied nations and the Axis powers consider submarines invaluable lies in the fact that more than one-third of the 1700 vessels forming the major naval units of the United States, British, Russian, German, Japanese and Italian navies are underseas craft.

Until a few weeks ago long-range Nazi U-boats were extremely active in the Battle of the Atlantic and in the Caribbean. Men, mechanical equipment, ammunition, food, ships, and war's lifeblood—oil—were being sent to the bottom at a dangerous rate.

Our long coastline, only partially protected at that time by patrol vessels, blimps and planes, offered no haven for slow, plodding freighters, but the ocean depths provided perfect hiding places for packs of enemy subs.

A bewildered public inquired: "Where is the United States Navy? Why isn't something done about the sinkings?" Much of the Atlantic fleet was necessarily concerned with the Titanic task of convoying men and supplies to Great Britain and Russia via the northern sea lanes.

With the recent addition of numerous sub chasers and patrol vessels to provide adequate protection for great coastal convoys, the Nazi subs have had to change their hunting grounds. The number of sinkings has dropped to a small percentage of the mid-summer figures.

American submarine skippers rate the Nazi U-boats high and rightly so. Haven't they proved their destructive ability to the tune of several billion dollars since 1939?

On the other hand, there is a bright spot in the picture. Our Asiatic and Pacific fleet, strengthened with speedy, long-range subs—the finest and most powerful underseas craft in the world—is pounding away at the Jap navy and merchant marine with heartening results.

Just as the United States is vulnerable along her coasts, so are the Japs wide open for submarine forays along their lengthening supply lines and long lines of communication stretching from Tokyo to the Philippines, the Dutch East Indies and the Bay of Bengal. United States submarines prowling the China Seas, the Celebes Sea and the entire Pacific enjoy the same superiority as the Nazi terrorists preying on shipping in the Atlantic. Their battlefields extend for more than five thousand miles and they have sent more than one hundred and fifty Jap ships to the bottom with TNT-charges, "tin fish" and shell fire exploding in their bellies. On the debit side is the disappearance of perhaps four or five American subs.

The backbone of the entire submarine branch of our Navy is the comprehensive submarine training school where expansion predated the frenzied defense building program. New classroom buildings and dormitories were completed four years ago.

Consequently, when the commissioning of old submarines was ordered and the construction program stepped up, the training school was ready to cut the length of its courses in half and increase enrollment many-fold.

Every six weeks a new group of enlisted men—all volunteers—is graduated from the basic training course. Then they sign up for special classes in torpedoes, compass, radio and sound, electricity or Diesel engines. The basic course for officers has been boiled down to twelve intensive weeks.

That the morale in the submarine service is very high has been demonstrated time and time again. The case of Signalman Warren W. Smith, Jr., of Laporte, Texas, is only one of hundreds in the Navy Department's confidential files.

Smith was one of the survivors of an unexpected dunking in the *Squalus* a few years ago. It wasn't his first untoward experience. While serving on a pigboat in China in the middle thirties that ship ran aground on a sand bar in the Yangtze River and rolled over on her side like a wounded animal.

A few days after his twenty-six *Squalus* shipmates had been given a military funeral, Smith reported to the C. O. at the Portsmouth Navy Yard to request active duty.

"Haven't had much luck, have you, Smith?" the white haired officer smiled. "That China incident and now the *Squalus*. You're certain you want to continue on a submarine?"

"Yes sir," replied Smith.

"Very well, then. I have your transfer papers and orders to report to the R-10. Good luck!"

The crew of the R-10 eyed Smith with some trepidation when word of his experience spread around. They realized he was a good submariner but believed his presence foretold trouble. And they were correct.

In practice manoeuver the submarine was being readied to belch a water slug at an approaching destroyer in Long Island Sound when the tin can suddenly headed for the underwater craft at twenty knots. Lt. Donald F. Weiss, then skipper of the sub, snapped out orders for a fast dive—Smith's first since his detachment from the *Squalus*.

The sub submerged but not quite far enough as a grating sound soon disclosed. Unable to see the surface with the periscope, the officers knew it had been damaged. Upon surfacing they found that the destroyer had ripped off several inches of the instrument.

On the following day another pigboat fired a torpedo with a practice head, missed the R-10 by a foot. Returning to port that same afternoon the R-10 was almost rammed amidship by a freighter whose steering gear had jammed. Signalman Smith then became known as the Jonah of the ship.

Many submariners are superstitious. Some will spit on the tail of a torpedo before shutting the muzzle hatch. Failure to do this, they say, will bring a complete miss. One torpedoman paints eyes on the tin fish so they can "see" their way to the enemy. Aboard the R-10 a small Buddha purchased in Shanghai has a prominent place in the torpedo compartment. And before firing the tubes, someone always rubs Buddha's belly for luck.

Signalman Smith's so-called jinx is far from being laid. During one of my trips aboard the R-10 the sub surfaced under an ice floe and damaged some of her bridge structure. Another time one of the men found an obstruction lamp missing at the stern. Evidently some harbor debris had torn it off but Smith received the blame. And the fact remains that Smith has always been at the wheel either in the control room, in the conning tower or on the bridge whenever anything has happened.

To provide men like Signalman Smith with the world's largest fleet of underwater terrorists, the Electric Boat Company at Groton, Connecticut, is in the midst of a "Keep 'em Sliding" campaign. Already the shipyard has passed its goal of one launching a month. Nine thousand men work on a three-shift twenty-four hour day with only fifteen minute lunch periods.

The United States Navy has an imposing fleet of submarines on active duty at sea. This undersea force is being greatly augmented in the shipyards of the nation today. Recent Congressional appropriations provide for a still greater force of underwater terrorists—a submarine Navy that will eventually be the largest in the world.

RIDING THE RAPIDS OF THE GRAND CANYON

(Continued from page 17)

compartments which make it unsinkable. Two of these, roomy hatches fore and aft, served as storage space for the entire party's provisions and equipment.

Cataract boats are the safest that have been designed to date, but even they can be upset. It takes strength and experience to handle a half ton craft in rough water with oars which weigh twelve and a half pounds apiece.

"You're going to be wet ninety percent of the time," Dell warned us at the start. He erred on the conservative side. The party became practically amphibian. Although we soon were completely indifferent to the repeated soakings we received in every rapid, one of the most satisfying luxuries at the end of the day was a change to dry clothes.

But being constantly wet had its practical side. A merciless summer sun beats down into the barren canyons sending midday temperatures skyrocketing to 110-118, but as we were aircooled by evaporation all day long none of us suffered with the heat. And when the sun disappeared behind high piled thunder-clouds which gathered on the canyon rims each afternoon we actually became cold. Once, during a rainstorm, our teeth chattered so persistently we were forced to land and thaw ourselves out around a fire.

For four days we threaded the sixty mile length of Marble Canyon and, at Tanner Creek, we were ready to tackle the Grand Canyon. Marble Canyon had been a curtain raiser—now the main show was to begin. The Grand Canyon is by far the greatest of the nineteen gorges along the Colorado. More than five thousand feet deep, it is cut into the high plateaus of Arizona for two hundred and seventeen miles. Throughout most of its length the River is confined to a narrow, twisting, restless course between the somber, black walls of Granite Gorge, the oldest rock formation in the world. Deep in the Granite Gorge of the Grand Canyon are the most treacherous rapids of all and there many expeditions have come to grief.

The introduction to the Grand Canyon is dramatically sudden. Between Tanner and Bright Angel Creeks are three of the worst rapids on the Colorado—Hance, Sockdolager and Grapevine. The last two have a particularly evil reputation because black, precipitous walls hem them in. There is no way to walk around them and no method by which a boat can be lined from their rugged shores. Everyone who comes down the River must run Sockdolager and Grapevine.

There is a tingling feeling of suspense about running big rapids—half anticipation, half dread—which was intensified that morning by Norm's hair-raising stories about Hance, Sockdolager and Grapevine. Norm's method is strong medicine, but I suspect this watch-spring tension is the ideal attitude to run the Colorado. With it *danger can be fun.*

To balance the boats more evenly on the Big Day I shifted to the *Wen* with Norm and Agnes. Things started immediately. We had a wild ride down through Tanner, Unkar and Seventy-Five Mile Rapids, yet it was but a limbering up exercise for the deadly trio ahead. I had seen many holes, those dreaded traps for unwary boats, and had shuddered as I looked into them. But at Seventy-Five Mile we went into one! I was lifted clear of the deck and thumped back again with enough force to knock the wind out of me. We didn't upset, but Norm kept his record clean by a narrow margin that time.

Then came Hance. We saw immediately that it was worse than anything we had come through in Marble Canyon. Norm shook his head doubtfully, but decided that Hance could be run without passengers. So Agnes, Bill and I climbed gingerly around by the slippery rocks on the left bank, pausing now and again like ghouls to snap pictures of the boats as they shot down through the twenty-five foot waves. But all three, including Zee upright in his kayak, were waiting when we laboriously reached the bottom. Hance had been shot and now reposed in the expedition's bag. Luck was still with us.

Two miles below was Sockdolager—the most famous rapid on the Colorado. From a vantage point high on the left bank we looked down upon a raging, tempestuous riot of water thundering with irresistible force between grim, black crags. It

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RIDING THE RAPIDS OF THE GRAND CANYON

(Continued from page 31)

extended without a break as far as we could see. Boulders crashed and thudded in the River's bed, adding to the deafening roar, while the earth actually trembled underfoot. Sockdolager must be one of the world's most forbidding places. But there is only one way to leave for fairer lands—that is, to go through it!

We returned to the boats. I never saw Norm's face so serious as he prepared for the run.

We three in the *Wen* pushed off into Sockdolager. Dell, Bill and Zee watched from the bank, solemn and motionless.

Cataract boats are run backwards through rapids. In this way the boatman faces the rapids, can see where he is going, and make every stroke of the oars count pulling against the current. If passengers are carried, one sits in the fore part of the cockpit behind the oarsman, also facing the rapid, while the other rides the flat afterdeck. Stern foremost means that the second passenger takes the brunt of every wave. There is no perfect method for spreading a six foot man over a three by four space, so each passenger evolves his own system. Mine was to flatten myself, face down, into the smallest space possible, get an unshakable grip on the safety ropes and hope for the best.

But in Sockdolager there was no time for hope. All my attention was concentrated on sticking to the boat. I must have resembled a Mexican jumping bean as we bounced, leaped and nosedived through the waves at thirty miles an hour. Three times the *Wen* came within an ace of turning over. But Norm made it, pulling out into an eddy where, breathless we watched the other two boats careen drunkenly down the long stretch of rough water to join us. Sockdolager was bagged, but we could only breathe two thirds of a sigh of relief—Grapevine waited for us four miles below.

Grapevine proved to be a lively repetition of Sockdolager, a little worse, if possible. But once again we landed at the foot right side up, dripping but triumphant.

At four-thirty in the afternoon the expedition landed at Bright Angel Creek after the most thrilling twenty miles the Colorado has to offer.

Close by clear, sparkling Bright Angel Creek is Phantom Ranch, a popular dude resort connected with both the south and north rims by dizzy trails over which strings of mules daily bring loads of palpitating tourists. The six of us made the most of this one contact with civilization, revelling in the sybaritic pleasures of soft beds, cold drinks, showers and a swimming pool.

When we pushed off from the beach at Phantom Ranch we realized there was no turning back. We were leaving our last opportunity to desert the Colorado until we slipped down the final rapid into the quiet waters of Lake Mead, one hundred and ninety miles away. For ten days the six of us would be isolated at the bottom of one of the world's great gorges with no way out except by shooting a hundred roaring rapids.

At Hermit Falls, six miles below Phantom Ranch, we had our first lining job. There the River drops too fast even for spunky cataract boats to dare the thirty foot waves. Lining is an arduous task, sometimes taking three hours before the last boat is through. But to us it was a new experience spiced with a different kind of danger.

In lining, everything movable in the boats must be unloaded and portaged to the foot of the rapid. Then, with every man pushing and pulling with all his strength, the boats are eased down over boulders and cascades through narrow channels close to the shore. As the boats haltingly progress they are snubbed, first with the bow-line, then the stern-line, to prevent them from being whisked away by the current or smashing against a rock.

Day after day we traveled down the endless trench of the Grand Canyon, titanic, unscalable walls closing us in from the outside world. Our horizon became a vertical one because we were in a land of shadows where the sky was reduced to a strip of blue overhead. We speculated on what would become of us if we lost the boats. Food might be dropped from planes. But could we get out? None of us, strangely enough, mentioned the thing that in previous expeditions sometimes drove men insane, caused them to desert or die. That thing was claustrophobia—the feeling of being shut in without any means of escape. Maybe we were having too good a time. Possibly we never thought of it. I don't know.

Slowly but surely we ticked off the rapids: Granite Falls, Boucher, Bedrock, Deubendorff, Upset—all names which in the past have spelled disaster in Colorado River history. At One Hundred and Sixty Four Mile Rapid Zee Grant took his third spill, but arrived at the foot once again victoriously astride the capsized kayak. The River got three strikes on Zee but couldn't put him out!

Sixteen days from our start at Lee's Ferry we came to our last camp at Diamond Creek. Boulder Dam was still over a hundred miles away, but for most of that distance we would be towed down the blue waters of Lake Mead.

We laid over a day at our final River camp, spending most of the time enjoying a busman's holiday emerged in a Diamond Creek pool christened "Lake Zee" in honor of its chief engineer. After dinner Norm and Dell, with solemn rites, initiated four neophytes into the Ancient and Honorable Order of Colorado River Rats. It is an exclusive society and we were all proud to become members. But, speaking for myself, I fear that I am usurping a title to which I have no right. Rat is too ambitious a name for one whose contributions to the success of the expedition are so humble—River Mouse is all that I dare aspire to.

TAKING LESSONS FROM THE OCEAN

(Continued from page 30)

strictly banned. There is no working for grades, credits or marks. There are no examinations whatsoever. Every student works solely for his own instruction. There are other unusual angles. In the zoology course, for example, a class during its various field trips is divided into six teams made up of nine or ten students. Each student group is accompanied during various excursions by a totally different instructor. The scientific interests of these instructors vary. Every one of them is a trained specialist in certain phases of the investigation in hand. Thus, the student is familiarized with a half dozen points of attack to a specified problem.

As for field trips, it is the botany course that really gets around. They tell you to: "Join the botany class and see the world." Perhaps the term "field trip" is slightly misleading. A class will periodically drag the sea bottom for plant life from a boat. To go afoot may mean variously to sink knee deep in the muck of a cedar swamp, wade with uncertain footing in a fresh water pond and fight the waves of Vineyard Sound or Buzzards Bay.

It is the actual living material that is important. Jean Louis Agassiz, the great naturalist, used to say, "Study nature, not books." The Marine Biological Laboratory is the lineal descendant of Agassiz and obeys the dictum, although perhaps with some few reservations. It is considered that working materials cannot be properly understood when studied apart from their surroundings, that many of the broader problems of marine zoology in particular require intimate study of conditions as they exist.

Similarly for marine botany. Botanists will tell you that a fairly comprehensive study of plant life in any given inland locality is not difficult. The algae of the water world are different. You must search for them in their natural haunts. To preserve them in liquid is never satisfactory and in some instances it is impossible. All lose more or less of their essential qualities. It is only at a marine experimental station that the marine algae can be adequately studied. Fresh water algae also thrive in the ponds of Woods Hole.

The living material is invaluable to the department of embryology. Its laboratory work is carried on almost exclusively with eggs and embryos that are living matter. This offers exceptional opportunity to follow the development of various eggs from the time of fertilization till they have become complex organisms. In the average university laboratory the study is one of separate stages. Here in Woods Hole it is one of continuous vital processes.

Observation, naturally, is only a part of the MBL's comprehensive field. Dr. Lillie points out in this connection the progress of the biological sciences during the past forty to fifty years. Up till then a large share of what he terms "descriptive functions" of biological investigation had been accomplished. In other words, the identification, naming and description of various species of animals and plants as well as the study of the structures and their stages of development.

Then, came the new era. Dr. Lillie uses the significant word "control." He speaks also of the experimental method. It was now becoming apparent that all vital processes were susceptible of analysis into chemical and physical processes to an extent that justified the expectations of far-reaching control. Chemical and physical laboratories have been joined to the equipment of a biological laboratory. A famous example of "control" has been the previously mentioned fatherless sea urchin. But you can also witness in the Marine Biological Laboratory significant studies of cancer and the functioning of the human heart.

All this has brought international as well as national fame to the small village of Woods Hole. There may be foreign scientists that have never heard of Bunker Hill. But it is doubtful if you could find one of any standing that had never heard of Woods Hole.

Woods Hole has had plenty of time in which to get used to the presence of science. Its history as a biological center began as far back as the year 1871. It was then the eminent naturalist, Spencer F. Baird, founder of the United States Fisheries, discovered Woods Hole and its natural advantages. He opened a laboratory on Little Harbor, the first seacoast laboratory in this country.

A friend of Baird's, the late Professor Edmund B. Wilson describes him as a man of forceful but winning personality, a typical American of the old school that looked the part, trained as a field collector and unusually able but not over-sympathetic to the new movement in biology then taking place.

When the Marine Biological Laboratory came along seventeen years later it found itself headed by another man of forceful personality, yet one of a different stamp. Professor Charles Otis Whitman combined American training with European. Technically he was essentially a product of the European laboratories. Humanly he remained all American. But technically he was something new.

Meanwhile a name of greater prominence than either Baird or Whitman appeared upon the scene. This was none other than Jean Louis Agassiz. It was in 1873 that Agassiz established a laboratory and school on Penikese, a small island fifteen miles distant from Woods Hole in Buzzards Bay. Unfortunately, Agassiz died during the winter of that year. His son carried the laboratory on for another year, wished to move it to the more accessible Woods Hole. Numerous appeals to educational institutions for help were turned down. The school and laboratory ceased to exist.

The present Marine Biological Laboratory established in 1888 traces its roots to the short-lived Agassiz school on Penikese Island. It is significant that the young Charles Otis Whitman then a beginning biologist had been a student in that school. But the fortunes of the Marine Biological Laboratory were to be very different.

(Continued on page 34)

NATIONAL TRAVEL CLUB BULLETIN

OBJECTS: to create and promote interest in travel and exploration: to furnish its members information of travel and secure concessions for them: to work for the betterment of transportation facilities: to arouse public interest in the conservation of our natural resources, the preservation of historic sites; the development of our National Parks and playgrounds, and of our waterways, the protection of our forests and our wild animal and bird life: to assist the good roads, safety first, city beautiful, and all movements that make travel safe and attractive: and to establish a closer relationship with the peoples of the world in order to secure the cause of international peace and justice.

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HOPE FOR THE FUTURE

Under the pressures of war, chemical developments are proceeding so rapidly that "the world of 1940 has already become an antiquity."

"The inconceivables of only two years ago are today's realities."

These declarations were made at the opening session of the American Chemical Society in its convention at Buffalo by Dr. Charles M. A. Stine. New discoveries will transform our world. How will they effect automobiles, airplanes, railroads and transportation in general? Dr. Stine's answers to these questions is startling in its implications.

Dr. Stine emphasized that the war is compressing into the space of months developments which might have taken us half a century to realize if necessity had not forced the pace.

"These pressures are unprecedented," he said. "The developments are unprecedented. Give us a victorious peace and the freedom of enterprise it should guarantee, and our progress will be unprecedented. . . . Let our swords be mighty, and mighty indeed will be our plowshares."

Declaring that the outlines of this progress have already been traced, the chemist enumerated many separate scientific revolutions which are on the way.

Aluminum production by the end of next year, he said, will be seven times greater than it was in 1939 after fifty years of development. It will furnish in one year enough metal to build three times the number of passenger cars now operating on all American railroads.

Under war pressures to create better fuels for airplanes so much progress has been made, he declared, that "the petroleum chemist now sees all existing motors as out of date," for fuels can now be made that go beyond the octane scale.

"Since motor car production stopped," he added, "the shiny new models that are gathering dust in dealers' storerooms have aged, technically, at least two decades. We are now in the 1960's of motor cars, as measured by the old pace of development."

There will be sealed cooling systems, now used in aviation; weights may be half what they are. Power will be up and fuels may yield fifty miles to the gallon.

Until a few years ago, he pointed out, magnesium was a structural curiosity, while today, on the average, almost half a ton of it, taken largely from sea water by a chemical process, goes into every fighting plane that is built. After the war the nation's capacity for producing this lightest of all structural metals will be more than double its aluminum output in 1939.

More than a century was consumed in bringing the crude rubber production of the world up to a million tons a year.

"The United States alone," he declared, "is now undertaking to accomplish almost as mighty a feat in less than two years by the manufacture of chemical rubbers from petroleum, alcohol, coal and limestone."

The American aviation industry is establishing facilities for the manufacture in one year of almost double the number of airplanes it produced during the thirty-seven years of its history beginning with the Wright brothers at Kitty Hawk and culminating in the defense program.

"Today we produce to destroy," he declared. "But tomorrow we will produce to build, and we will continue to invent and thus to multiply our possessions. We will have at our command ten, fifty, a hundred times what we had before, chiefly of new materials.

"That prospect is as certain as tomorrow's dawn. We need only to make the victory definite. Then the choice will be ours, either boldly to harness the stream of plenty, or, if we are timid and of myopic or restricted vision, to be embarrassed by the very abundance of means we have created.

"If I know the American chemist, his will be the bold course — the course toward a better destiny. And all science will set its course by the same compass."

Many other new things were discussed by Dr. Stine for the post-war world — new fabrics for clothing, steel that will challenge the new light metals, things to be made from the chemical building blocks of hydrogen and carbon that come out of the thousands of chemical compounds in every barrel of crude oil, new houses made cheaply of new materials and painted with new paints, developments in medicine which "may ultimately outweight by many times even the staggering losses of the world-wide conflagration."

AIRWAYS TO MEXICO

American Airlines' regularly scheduled passenger, mail and express service between the United States and Mexico became a fait accompli recently when A. N. Kemp, president of the airline, announced the inaugural flight for September 5, with regular flights beginning September 8.

American Airlines has built a completely equipped airport at Monterrey, a number of lighted auxiliary airports in Mexico, a hangar, a weather reporting station and radio station on the Mexico City airport, as well as installing a radio range along the entire route to permit day and night operation in all weather conditions.

Gateways for the international service have been established in Fort Worth and Dallas, Texas, for passengers from the central and eastern United States and at El Paso, Texas, for west coast passengers.

FREIGHT CARS WITH WINGS

The inaugural of the first scheduled commercial all-cargo service by an international air carrier certified by the Civil Aeronautics Board has been announced at the New York Office of Pan American-Grace Airways (Panagra). The beginning of regular schedules on the 1678 mile sector of Panagra's trunk line, from Balboa, Canal Zone, to Lima, Peru, follows the completion of four round trip test flights. These have served to establish the value of such a service and have already confirmed the fact that separate freight operations result in material improvement to the regular daily passenger, mail and express services of the company, which are now primarily of war priority classification.

While no new flying equipment has been received, Panagra is neverthless able to conduct these weekly freight operations by a thorough redistribution of existing equipment and flying personnel which will permit the allocation to cargo schedules of two Douglas DC-2 transports formerly used in domestic operations in Ecuador. These planes have been converted to freight-craft by the removal of all passenger equipment. Payloads on the preliminary flights already completed averaged approximately 1450 kilos (3300 pounds.) In this way blacklogs of non-priority commercial express, in many cases representing machinery, tools and commodities urgently needed in the republics on the West Coast of Latin America, have already been materially reduced, while north bound a flow of valuable high-unit-cost raw materials has been established.

NOTICE TO MEMBERS

Members are requested to eliminate the following names from their Official Hotel Booklet.

MARYLAND—Emerson Hotel, Baltimore.

NEW YORK—Victoria Hotel, New York City.

TAKING LESSONS FROM THE OCEAN

(Continued from page 32)

Like many another worth-while project its beginnings were uncertain and precarious, the equipment inadequate. Of the assured scientific cooperation which is its mainstay today there was none. But it possessed a natural location unrivaled and a less easily defined spiritual craving for more knowledge that has lived through fifty-four years and shows no signs of abatement.

The laboratory has more than justified the ambitions of its founders. Between 1919 and 1923 a million dollar fund was raised for which both the Rockefeller Foundation and the Carnegie Corporation wrote six figure checks. Other emoluments have followed. A year ago the Rockefeller Foundation gave one hundred thousand dollars for an addition now completed of one of the most comprehensive scientific libraries in the world. The buying and current expenses of this library alone runs to nearly twenty thousand dollars a year.

More than eighty universities, colleges and research organizations subscribe annually to the MBL, their representatives periodically putting in a personal appearance. Research facilities are on an equal footing to all. A poverty stricken small college working with horse and buggy age equipment at home finds itself here just exactly as well off as Harvard, the Rockefeller Foundation, or Yale. About thirty States are represented during any summer's school or research session at Woods Hole and even during these perilous times there are at least a half dozen foreign countries. The Laboratory is equally open minded on the personal biological views any one brings. You can think what you like. It has no program of its own. Its aim is to provide suitable facilities for all kinds of biological work.

Thus, as Professor Conklin points out, the Marine Biological Laboratory has come up from a condition of penury to one of affluence, from a day of small things to one of greatness, from anxious hope to glorious realization.

There is no doubt about it, we can go on taking lessons from the sea for a long time to come.

AMERICA'S NEW WILD LIFE INDUSTRY

(Continued from page 27)

these turkeys come in contact with their human protectors more than possible. He should feed them sight unseen in order to bring them up in the way they should go without their knowing too much about it.

The principal wild waterfowl raised under domestic conditions are the mallard duck and Canada goose. To produce these birds a pond or lake is essential. The pond shore is well covered with marshy growth and other thick plant life for covers and nesting. The pond and ample shore land are enclosed with a closely woven wire fence. Birds are confined by pinioning or wing-clipping. The eggs are laid in nests well protected by the marshy shore cover and hatched and brooded artificially.

The chief game animals domestically produced are the fur bearers, such as the fox, raccoon and mink. The two latter are usually raised in wire-enclosed kennels. It costs $2 to $4 to raise a mink in captivity. Mink furs are valuable and bring $10 to $18 each. Both the raccoon and mink are easily domesticated and become fond and devoted pets.

The silver fox is more widely grown in captivity than the other fur bearers. The pelt of this animal makes one of the most valuable furs in existence. Only ladies with fat purses or magnanimous husbands can afford silver fox coats.

Probably the largest silver fox farm in the United States is one owned by the Fromm Brothers near Hamburg, Michigan. At this 12,000-acre farm 50,000 of these animals are kept. They are held in forty-acre fenced tracts and allowed to bear their young in caves and dens in regular wild fox style. The animals mate in February and the female gives birth to a litter of two to six pups. At a 1936 auction Fromm Brothers sold one million dollars worth of furs.

There are now four thousand silver fox farms in the United States and six thousand in Canada.

America's new wildlife industry has opened up a vast new field of salaried carers and specialized training. Many colleges now give special courses in this work. Training courses in both forestry and wildlife are essential for many of the jobs in federal and state conservation.

Uncle Sam has 163 national forests totaling 175,000,000 acres. Each of these forests is controlled by a forest supervisor. Every forest is divided into districts, each of which is in charge of a forest ranger. His job is to protect his district against fire, see that the game birds and animals are getting plenty to eat and are protected against winter starvation. He must also protect them against animal and human marauders.

In addition to the forest ranger the federal government employs hundreds of game wardens, fish culturists, biological aides and others who have taken special college courses in game work. College trained men are also used by all the forty-eight states, on private game farms and hunting preserves owned by sporting clubs to take charge of breeding work, to give demonstrations in wildlife care, furnish advice and cooperation to private producers and protect game preserves closed to hunting.

Government investment in wildlife conservation is by no means another waste of taxpayers' money. It is a program that is paying its way. The replenishment of our game lands keeps alive a vast sporting industry that produces multiplied millions in the sale of hunting arms and munitions, hunting excursions to game areas, and sale of hunting and breeding licenses. The federal funds provided for the states under the Robertson-Pittman Game Act of 1938 are raised from taxes collected from manufacturers of guns, cartridges and similar hunting material which couldn't be manufactured at all if no hunting was to be had.

The states also find this new industry a paying investment. In Michigan and Wisconsin, for instance, it was shown that for every dollar the state paid for the purchase of restock game birds for the protected areas, it got back three dollars in the form of hunting licenses and extra income to private citizens. There are now millions of sportsmen in this country who offer a strong demand for all the game birds and animals the government can get somebody to produce.

* * *

HOW AMERICA INVADED BERMUDA

(Continued from page 11)

liard tables and the floor. Here sailors receive medical treatment, convalesce and rest. "And we honor them if they die," said the seamen's pastor. "We know the rites of all religions from Hebrew to Chinese. We arrange funerals, provide pall bearers and wreaths, drape the ensign, attend the funeral and write home about it. We never have made a question of class, color or creed and never intend to—Amen!"

The United Services Club, which opened April 1941 in the Hamilton Hotel for white enlisted men of the Allied Forces, was organized by Mr. Wendell Anderson of Detroit and a group of American civilians interested in recreation programs for the American forces. The courtesies of the Club are extended to all enlisted men of the Allied Forces. Here British tars, De Gaulle's men, Highlanders and Netherlanders get acquainted with the American hot dog, hamburger and coco cola. On a scorching day five thousand tins of beer go down the scuppers. At a table in the bar, an American sailor sat across from a diminutive British tar of His Majesty's Navy. The gob raised himself to speak over a pyramid of seventeen empty beer tins. "Ya know, Limey, what this country needs is a good five cent subway." "Well, Matey," answered the tar as he squinted around the side of the pyramid, "If hit's a tuppenny tchube ya mean, I agree with ya."

The first Overseas Club of the United Services Organization was established in Bermuda in September 1941 with Mr. Leonard R. Hall as its director. The lovely Coral Island Hotel, dear to the hearts of honeymooners and tourists, was leased, renovated and equipped as the principal recreation center while playing fields and courts were developed in needy places over the islands.

From the club verandah our soldiers, sailors and marines dive into the clear emerald ocean tides that pour back and forth through the narrow channel of Flatts inlet. The staff ladies have stitched up five hundred bathing trunks for the unprepared, thereby depleting shop shelves of their best cotton. There are plenty of canoes and rowboats and the boys reel for rockfish, bonita, grunt and the delicious native hamlet. Beach parties, moonlight bathing and dog roasts are frequent.

Isolated Castle Harbor Hotel, once a luxurious winter resort for fat purses, is now a garrison home for soldiers. The interior was stripped of carpeting, luxurious furnishings and *objets d'art* to make way for O.D. cots and blankets, soldier trunks and gun racks.

Perhaps the transformation of this luxurious hotel symbolizes most emphatically the changes that have taken place in Bermuda since the war. Once the island's name was symbolic of peace—"the still vexed Bermoothes" was Shakespeare's phrase—but today there is war. One sees little of the gaiety of the past. Many of the famous bars and night clubs are still open, but under war-time restrictions. Former visitors will remember festive nights at 21; at the Swank Ace of Clubs; at the Quarry Bar made famous by the gold fish swallowing craze; at the Imperial where ratings toast with "Nelson's Blood" and at many other delightful cafés and restaurants where so many people gathered. These places are crowded today with army and navy men—during the periods allotted by the high command—but for all the laughter the atmosphere is strangely different. And as one leaves at the closing hour there is still the sweet scent of oleander and jasmine, but the streets are pitch black and there is the sinister hum of airplanes on patrol. Yes, the Bermuda that was once the haven of the lotus eaters today is a bastion in the Atlantic, one of America's vital outposts in the greatest struggle the world has ever known.

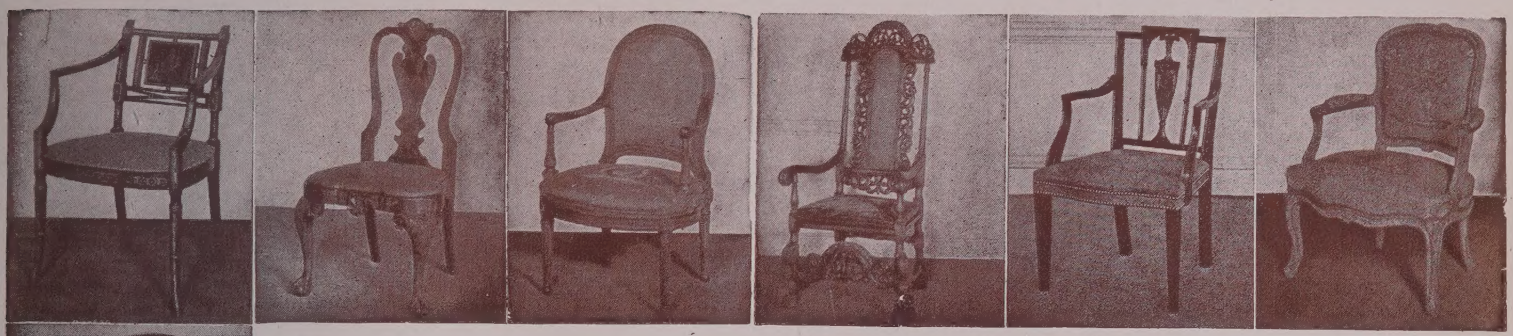
* * *

TEST YOUR KNOWLEDGE . . . .

NOT A GAME, BUT SOME SERIOUS QUESTIONS—

CAN YOU—

1. Identify each of these chairs as to period and country?



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Travel—October, 1942

2. Choose the correct room in the house for each?

3. Tell which could be used together in the same room?

4. Select the furnishings and accessories to harmonize with them?

5. Take any one as a nucleus and create a charming room around it?

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To enjoy the full measure of the beauty of a great work of art, you must know something of the general school that influenced the artist, something about the work of his contemporaries, something about form, color treatment.

The same is true of furniture. No matter how many fine and costly pieces you may examine, or own, you can never hope to appreciate them intelligently until you know something of their background.

But of more importance is the great personal satisfaction a thorough knowledge of the subject will bring you, a subject which is constantly by your side. Wherever you turn, there are beautiful interiors offering themselves for your enjoyment. The lines of a chair, the detail of its carving, the scenes its historical background call to your imagination, provide a fascination which will never allow you a moment of boredom.

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AUTUMN 1942

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by Alfred Sternbeck

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by Dickey Meyer

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by Louise Hall Tharp

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by Charles Willard Diffin

The thrilling story of Rak, the cave boy, who hunted with his long spear in the jungles long ago. As Rak grew up and explored the vast world far from his own caves, he found adventure waiting at every turn of the trail. Filled with action and suspense, against a background of authentic fact, this is a book that will delight boys and girls alike. Illustrated by Alyn, $2.50.

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by Elizabeth Kent Tarshis

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THE BANDS PLAY ON

by Phyllis Ann Carter

This colorful history of how and where and when men have made orchestral music, from the wandering minstrels of long ago to American swing bands of today, is told with immense gusto. Curious instruments, the fascinating story of martial music, the growth of dance tunes and jazz—all these are part of a book that will make its readers want to hear and play more music. Illustrated by William Sharp, $2.00.

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